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Fundamentals of Computer and Applications

Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

Phone : 5639122/6634373/6635046/6630088
Website- https://www.moecdc.gov.np
Email- info@moecdc.gov.np

Technical and Vocational Stream
Learning Resource Material

Fundamentals of Computer and Applications
(Grade 9)
Computer Engineering

Government of Nepal
Ministry of Education, Science and Technology
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Preface

The curriculum and curricular materials have been developed and revised on a regular basis with the aim of making education objective-oriented, practical, relevant and job oriented. It is necessary to instill the feelings of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline, self-reliance, creativity and thoughtfulness. It is essential to develop linguistic and mathematical skills, knowledge of science, information and communication technology, environment, health and population and life skills in students. It is also necessary to bring the feeling of preserving and promoting arts and aesthetics, humanistic norms, values and ideals. It has become the need of the present time to make them aware of respect for ethnicity, gender, disabilities, languages, religions, cultures, regional diversity, human rights and social values to make them capable of playing the role of responsible citizens with applied technical and vocational knowledge and skills. This learning resource material for computer engineering has been developed in line with the Secondary Level computer engineering Curriculum with an aim to facilitate the students in their study and learning on the subject by incorporating the recommendations and feedback obtained from various schools, workshops, seminars and interaction programs attended by teachers, students, parents and concerned stakeholders.

In bringing out the learning resource material in this form, the contribution of the Director General of CDC Mr. Yubaraj Paudel and members of the subject committee Dr. Baburam Dawadi, Dr. Sarbim Sayami, Mrs. Bibha Sthapit, Mrs. Trimandir Prajapati is highly acknowledged. This learning resource material is compiled and prepared by Mr. Bimal Thapa, Mr, Rajendra Rokaya, Mr. Suresh Shakya. The subject matter of this material is edited by Mr. Badrinath Timsina and Mr. Khilanath Dhamala. Similarly, the language is edited by Mr. Binod Raj Bhatta. CDC extends sincere thanks to all those who have contributed to developing this material in this form.

This learning resource material contains a wide coverage of subject matters and sample exercises which will help the learners to achieve the competencies and learning outcomes set in the curriculum. Each chapter in the material clearly and concisely deals with the subject matters required for the accomplishment of the learning outcomes. The Curriculum Development Centre always welcomes creative and constructive feedback for the further improvement of the material.

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Table of Content

Guidelines to Teachers

A.   Facilitation Methods

The goal of this course is to combine the theoretical and practical aspects of the contents needed for the subject. The nature of contents included in this course demands the use of practical or learner focused facilitation processes. Therefore, the practical side of the facilitation process has been focused much. The instructor is expected to design and conduct a variety of practical methods, strategies or techniques which encourage students engage in the process of reflection, sharing, collaboration, exploration and innovation new ideas or learning. For this, the following teaching methods, strategies or techniques are suggested to adopt as per the course content nature and context.

Brainstorming

Brainstorming is a technique of teaching which is creative thinking process. In this technique, students freely speak or share their ideas on a given topic. The instructor does not judge students' ideas as being right or wrong, but rather encourages them to think and speak creatively and innovatively. In brainstorming time, the instructor expects students to generate their tentative and rough ideas on a given topic which are not judgmental. It is, therefore, brainstorming is free-wheeling, non-judgmental and unstructured in nature. Students or participants are encouraged to freely express their ideas throughout the brainstorming time. Whiteboard and other visual aids can be used to help organize the ideas as they are developed. Following the brainstorming session, concepts are examined and ranked in order of importance, opening the door for more development and execution. Brainstorming is an effective technique for problem-solving, invention, and decision-making because it taps into the group's combined knowledge and creative ideas.

Demonstration

Demonstration is a practical method of teaching in which the instructor shows or demonstrates the actions, materials, or processes. While demonstrating something the students in the class see, observe, discuss and share ideas on a given topic. Most importantly, abstract and complicated concepts can be presented into visible form through demonstration. Visualization bridges the gap between abstract ideas and concrete manifestations by utilizing the innate human ability to think visually. This enables students to make better decisions, develop their creative potential, and obtain deeper insights across a variety of subject areas.

Peer Discussion

Peer conversation is a cooperative process where students converse with their peers to exchange viewpoints, share ideas, and jointly investigate subjects that are relevant or of mutual interest. Peer discussion is an effective teaching strategy used in the classroom to encourage critical thinking, active learning, and knowledge development. Peer discussions encourage students to express their ideas clearly, listen to opposing points of view, and participate in debate or dialogue, all of which contribute to a deeper comprehension and memory of the course material. Peer discussions also help participants develop critical communication and teamwork skills by teaching them how to effectively articulate their views, persuasively defend their positions, and constructively respond to criticism.

Peer conversation is essential for professional growth and community building outside of the classroom because it allows practitioners to share best practices, work together, and solve problems as a group. In addition to expanding their knowledge horizon and deepening their understanding, peer discussions help students build lasting relationships and a feeling of community within their peer networks.

Group Work

Group work is a technique of teaching where more than two students or participants work together to complete a task, solve a problem or discuss on a given topic collaboratively. Group work is also a cooperative working process where students join and share their perspectives, abilities, and knowledge to take on challenging job or project. Group work in academic contexts promotes active learning, peer teaching, and the development of collaboration and communication skills. Group work helps individuals to do more together than they might individually do or achieve.

Gallery Walk

Gallery walk is a critical thinking strategy. It creates interactive learning environment in the classroom. It offers participants or students a structured way to observe exhibition or presentation and also provides opportunity to share ideas. It promotes peer-to-peer or group-to-group engagement by encouraging participants to observe, evaluate and comment on each other's work or ideas. Students who engage in this process improve their communication and critical thinking abilities in addition to their comprehension of the subject matter, which leads to a deeper and more sophisticated investigation of the subjects at hand.

Interaction

The dynamic sharing of ideas, knowledge, and experiences between people or things is referred to as interaction, and it frequently takes place in social, academic, or professional settings. It includes a broad range of activities such as dialogue, collaboration or team work, negotiation, problem solving, etc. Mutual understanding, knowledge sharing, and interpersonal relationships are all facilitated by effective interaction. Interaction is essential for building relationships, encouraging learning, and stimulating creativity in both in-person and virtual contexts. Students can broaden their viewpoints, hone their abilities, and jointly achieve solutions to difficult problems by actively interacting with others.

Project Work

Project work is a special kind of work that consists of a problematic situation which requires systematic investigation to explore innovative ideas and solutions. Project work can be used in two senses. First, it is a method of teaching in regular class. The next is: it is a research work that requires planned investigation to explore something new. This concept can be presented in the following figure.

Project work entails individuals or teams working together to achieve particular educational objectives. It consists of a number of organized tasks, activities, and deliverables. The end product is important for project work. Generally, project work will be carried out in three stages. They are:

- Planning
- Investigation
- Reporting

B.   Instructional Materials

Instructional materials are the tools and resources that teachers use to help students. These resources/materials engage students, strengthen learning, and improve conceptual comprehension while supporting the educational goals of a course or program. Different learning styles and preferences can be accommodated by the variety of instructional

resources available. Here are a few examples of typical educational resource types:

- Daily used materials
- Related Pictures
- Reference books
- **Slides and Presentation:** PowerPoint slides, keynote presentations, or other visual aids that help convey information in a visually appealing and organized manner.
- **Audiovisual Materials:** Videos, animations, podcasts, and other multimedia resources that bring concepts to life and cater to auditory and visual learners.
- **Online Resources:** Websites, online articles, e-books, and other web-based materials that can be accessed for further reading and research.

Maps, Charts, and Graphs: Visual representations that help learners understand relationships, patterns, and trends in different subjects.

Real-life Examples and Case Studies: Stories, examples, or case studies that illustrate the practical application of theoretical concepts and principles.

C.   Assessment

Formative Test

Classroom discussions: Engage students in discussions to assess their understanding of concepts.
Quizzes and polls: Use short quizzes or polls to check comprehension during or after a lesson.
Homework exercises: Assign tasks that provide ongoing feedback on individual progress.
Peer review: Have students review and provide feedback on each other's work.

Summative Test

Exams: Conduct comprehensive exams at the end of a unit or semester.
Final projects: Assign projects that demonstrate overall understanding of the subject.

Peer Assessment

Group projects: Evaluate individual contributions within a group project.
Peer feedback forms: Provide structured forms for students to assess their peers.
Classroom presentations: Have students assess each other's presentations.

Objective Test

Multiple-choice tests: Use multiple-choice questions to assess knowledge.

True/False questions: Assess factual understanding with true/false questions.

Matching exercises: Evaluate associations between concepts or terms.

Portfolio Assessment

Compilation of work: Collect and assess a variety of student work samples.

Reflection statements: Ask students to write reflective statements about their work.

Showcase events: Organize events where students present their portfolios to peers or instructors.

Observational Assessment

Classroom observations: Observe students' behavior and engagement during class.

Performance observations: Assess practical skills through direct observation.

Field trips: Evaluate students' ability to apply knowledge in real-world settings.

Abbreviation

AI	Artificial Intelligence
ARPANET	Advanced Research Projects Agency Network
AT	Advanced Technology
ATM	Automated Teller Machine
AVI	Audio Video Interleave
BCR	Bar Code Reader
Bit	Binary Digit
CAD	Computer Aided Design
CD-ROM	Compact Disk Read Only Memory
CD-RW	Compact Disk Rewritable
CFL	Compact Fluorescent Lamp
CPU	Central Processing Unit
CRT	Cathode Ray Tube
DRAM	Dynamic Random Access Memory
DVD-ROM	Digital Versatile Disk Read Only Memory
EB	Exa Byte
EEPROM	Electrically Erasable Programmable Read-Only Memory
EPROM	Erasable Programmable Read-Only Memory
FDD	Floppy Disk Drive
FLOPS	Floating-point operations per second
FTP	File Transfer Protocol
GIGO	Garbage In Garbage Out
GPS	Global Positioning System
GPS	Global Positioning System
GUI	Graphic User Interface
HTML	Hypertext Markup Language
IBM	International Business Machine

ICT	Information and Communication Technology
ICU	Intensive Care Unit
IoT	Internet of Things
IRC	Internet Relay Chat
ISP	Internet Service Provider
KB	Killo Byte
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LPM	Lines Per Minute
MB	Mega Byte
MHz	Mega Hertz
MICR	Magnetic Ink Character Reader
MPEG	Moving Picture Experts Group
NIC	Network Interface Card
OCR	Optical Character Reader
OMR	Optical Mark Recognition
PB	Peta Byte
PC	Personal Computer
PDA	Personal Digital Assistant
PDP	Plasma Display Panel
PROM	Programmable Read-Only Memory
PS/2	Personal System-2
RAM	Random Access Memory
RDP	Remote Desktop Protocol
ROM	Read Only Memory
SRAM	Static Random Access Memory
SSD	Solid State Drive
SSH	Secure Shell

TB	Tera Byte
TCP/IP	Transmission Control Protocol/Internet Protocol
URL	Uniform Resource Locator
USB	Universal Series Bus
VDU	Visual Display Unit
VGA	Video Graphic Array
VNC	Virtual Network Computing
VOIP	Voice Over Internet Protocol
VR	Virtual Reality
WMV	Windows Media Video
WWW	World Wide Web
XT	eXtended Technology
YB	Yotta Byte
ZB	Zetta Byte

Fundamentals of Computer and Application

1.1 Introduction to Computer

The word 'Computer' is derived from the Latin word 'Computare', which means 'to calculate'. We all need to perform mathematical calculations in our day-to-day lives. When the calculations are simple, we feel easy and can perform the calculations accurately in a short time. But complex calculations take longer time and the accuracy is not always 100 percent. So man explored the idea of developing a machine that can perform mathematical calculations quickly and accurately. This gave birth to a device or machine called a 'computer'. The idea of developing a computer was first introduced by the British mathematician Charles Babbage. Based on Charles Babbage's idea, an American physicist, Howard Aiken, developed the first computer, 'Mark I', in 1937. In the early days, the computer was not so capable of performing a variety of tasks. In the early days, computers were not so advanced and could only do limited tasks.

In this modern era, we can't think of living without a computer. It helps us perform many different tasks quickly, accurately, and in an organized way. It takes data and instructions from a user, processes them quickly, accurately, and in organized ways, and gives the information.

So, a computer is a programmable electronic device that can convert or process data under the control of a set of instructions (i.e., program) and produce output (i.e., information). It allows us to store the information for future use.
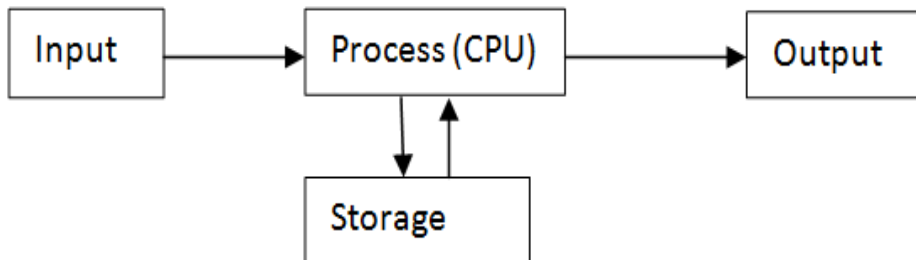
Mark I	*Desktop PC*

Computer consists of input, process, output and store as IPOS. The block diagram of IPOS cycle of computer system as

Input: Enter data into the computer.

Process: Process data to produce information.

Output: Display information.

Storage: Store data and information

1.2 Characteristics of Computer

There are many electronic devices, but those devices do not have all the characteristics that a computer possesses. The following are the characteristics of a computer:

i. Speed

A computer works on low or high signals of electricity. These two different states of electric signals are represented on a computer by using binary numbers 1 and 0. The circuitry of a computer is designed in such a way that electric signals travel at the speed of light, so the processing speed of a computer is high. It takes only a few seconds for calculations that we take hours to complete. The weather forecasting that you see every day on TV is the result of the compilation and analysis of huge amounts of data on temperature, humidity, pressure, etc. from various places on computers. It takes a few minutes for the computer to process the huge amount of data and give the result.

It can process millions (1,000,000) of instructions or even more in a second. The table below shows the speed of computer in different units of time.

Unit of Time	Part of Second	Power of 10	
Millisecond (ms)	1/1000	10^{-3}	One Thousandth
Microsecond (µs)	1/1000000	10^{-6}	One Millionth
Nanosecond (ns)	1/1000000000	10^{-9}	One Billionth

Picosecond (ps)	1/1000000000000	10-12	One Trillionth
Femtosecond (fs)	1/1000000000000000	10-15	One Quadrillionth

ii. Accuracy

A computer performs calculations accurately. It is a 100% accurate device. It does not make any kind of mistake and does not produce the wrong information. But sometimes, due to incorrect input (data or instruction) or faults in hardware or programs, a computer may produce incorrect output. The incorrect output produced due to incorrect input is referred to as Garbage In Garbage Out (GIGO). An error due to the malfunctioning of hardware or programs is referred to as a bug.

iii. Automatic

A computer is an automatic machine. Once you have fed instructions to the computer, you don't need to instruct it again and again. It can do the tasks automatically, as instructed by a program.

iv. Storage

A computer has storage capacity. It can store a large volume of data, information, and programs on storage devices like hard disks, optical disks, Blu-ray disks and flash drives as files. These storage devices store data, information, and programs as long as desired by the user and can be used whenever required. The storage capacities (memory size) of storage devices are measured in bytes and higher units of bytes. One byte is needed to store one character. The different units of storage are shown below.

1 Bit = 1 or 0
4 Bits = 1 Nibble
8 Bits = 1 Byte
1024 Bytes= 1 KB
1024 KB = 1 MB
1024 MB= 1 GB
1024 GB = 1 TB
1024 TB = 1 Peta Byte

1024 PB = 1 Exa Byte
1024 EB = 1 Zetta Byte
1024 ZB = 1 Yotta Byte

v. Diligence

A computer can perform the task repeatedly without losing speed and accuracy for a long time. The capability of a computer to perform a task repeatedly without losing speed and accuracy for a long time is known as diligence. Due to this characteristic of a computer, it is also called a diligent machine. This capability of the computer makes it useful for quality control and process control tasks.

vi. Versatility

A computer is a versatile machine. Versatility refers to the capability of doing various kinds of tasks. Due to the versatile nature of a computer, it is used in almost all fields. It can be used for calculation, preparation of documents, designing, researching, and entertaining. It can even be used for transferring e-mails, e-faxes, messages, and files from one computer to another computer in any place in the world.

1.3 Modern Application of Computer

Due to the versatile abilities of a computer, it has become one of the most important tools for people. People can perform tasks more quickly, correctly, efficiently, and systematically with the help of computers. Computers make people efficient and productive, and they also free up their time for other tasks. People are not only using computers for preparing documents, spreadsheets, presentations, graphics, etc. They are using computers for modern facilities like instant messaging, video chatting, email, online gaming, online shopping, ticketing, booking, checking and transferring money in banks, finding the latest news and information, etc. So, computers are used in nearly every field. The following are some important application of computers:

i. Education Sector

Computers are used in education sector for teaching

Computer in Education

and learning purposes. Using computers, students can learn different subjects through the websites on the Internet. Teachers can prepare the teaching materials and present them effectively through multimedia computers. Computers are also used in education for keeping records of students, producing monthly bill statements, and results of examinations.

ii. Health and Medical Sector

Computers are used in health and medical sectors like hospitals, labs, and clinics. Computers are used in hospitals to keep the medical information of patients, such as tests, diagnoses, previous treatments, etc. Computers are also used for conducting various clinical and

Computer in Hospital

biological laboratory tests in hospitals and labs. Eye doctors use computers to examine patients' eyes. Surgeons use computerized robotic surgical devices to perform delicate surgical operations. In hospitals, critical patients' heart rate, pulse rate, brain reading, etc., are recorded and monitored continuously through computers. Computers are used in medical research centers to research new medicines and causes of diseases.

iii. Financial Sector

Almost all banks, cooperatives, and financial industries are using computers to make their services fast, accurate, and efficient. The computers in the financial sector help to keep the accounts of customers up-

Computers in Bank

to-date. When a customer deposits or withdraws cash, the account is updated automatically by the computers. The computers in the banks calculate the payment, interest, and balance of the customers. The computers on the banks help to provide online banking facilities to their customers. Using the facilities of online banking, customers can check their balance, get statements, and transfer money to their mobile wallets and other bank accounts.

iv. **Offices**

Computers in offices make employees efficient and productive. With the help of computers, employees can do their day-to-day tasks like preparing documents, presentations, and salary sheets and communicating with clients in a fast, accurate, and organized way. Computers are also used to keep records of staff in offices. Nowadays, offices are also using biometric attendance systems. Some offices, such as Nepal Telecom, Nepal Electricity Authority, Department of Transport Management, etc., are providing online services to their customers.

Computer in Office

v. **Business**

Computers can help businesses by making their staff efficient and productive and also save their valuable time. Computers in business help to keep all the products and sales data accurate. It helps to do sales analysis and financial forecasting of businesses. Computers are used to maintain the business account and to promote the


Computer in Business

business through social media marketing, email campaigns, etc. Nowadays, the concept of cloud computing is used. The cloud computing in the business allows authorized users to access applications and data from anywhere. Authorized users and staff can work remotely from all over the globe. Meetings, presentations, and conferences can be held at any location. Computers are also used in business to create electronic receipts, manage expenses, etc.

Nowadays, people can purchase or sell goods and services online. It makes buying and selling activities easier, more efficient, and faster.

vi. Entertainment Sector

Computers are being used in the entertainment sector. Computers are used in composing music, adding special effects to songs and movies, and enhancing audio and video quality. They are being used to develop cartoons and animated movies.
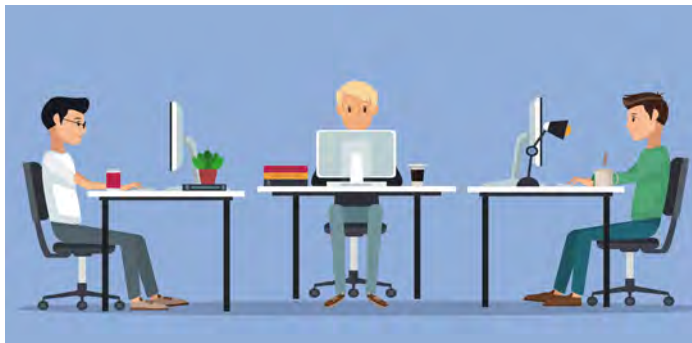
Computer in Entertainment

vii. Home

Nowadays, people use computers to communicate with each other through social networking sites like Viber, Twitter, Facebook, WhatsApp, etc. Most people at home use computers for entertainment. They spend most of their time watching videos on YouTube. Some people use computers at home for preparing documents, presentations, and spreadsheets; sending

Computer at Home

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or receiving emails; keeping information; searching information on the web; accessing online banking facilities; buying and selling goods online; etc.

viii. Transportation

Modern vehicles use computer-controlled units through which fuel consumption and safety features like airbags, anti-lock brakes, etc. are controlled. Modern vehicles have computerized GPS (Global Positioning System) that informs

Computer in Vehicle

drivers of their location and guides them to find a specific destination by showing directions.

Computers are used to control the traffic lights on the road. Metro trains and bullet trains are controlled by the use of computers. The computerized system on railways prevents train-to-train collisions. It also prevents trains from derailment (running off from the rail/track) due to excessive speed. The landing and takeoff of aeroplanes are managed and controlled by computers.

ix. Engineering Designing

Computers are used in engineering designs. Engineers use CAD (Computer Aided Design) software for designing machines, cars, buses, motorcycles, airplanes, buildings, bridges, and roads.

Computer in Engineering Designing

x. Industry

Computers are used in big industries especially to control machines and tools. Computers are used to monitor and control the quality of products. In factories like car manufacturing factories, aircraft manufacturing factories,

Computer in Industry

microprocessor manufacturing factories, and many other factories, computer-controlled machines '**ROBOTS'** are used for picking and placing different parts, welding, painting or assembling the products, etc.

xi. Defense System

A computer performs vital functions to control the defense system. Computers are used to track airplanes, missiles, tanks, and different kinds of weapons. Once the radar system tracks a missile, artificial intelligence is programmed to target

Computer in Defense

the missile and destroy it before it reaches the surface. It is also used for GPS tracking, controlling defense vehicles, and keeping records of all members of the military.

1.4 Classification of Computer

Different types of computers are used in different areas. Computers used at offices, homes, hospitals, and research centers may be different. They may differ in size, tasks, purpose, model, and brand. Computers can be classified based on size, data handling capability, purpose, model, and brand.

1.4.1 On the Basis of Sze

On the basis of size, computers are classified in four categories. They are:

i.   **Microcomputer**

ii. **Minicomputer**

iii. **Mainframe computer**

iv. **Supercomputer**

i.   **Microcomputer**

A microcomputer is a single-user general purpose computer that is smaller than a minicomputer. It consists of a microprocessor as the main component. It is also called a personal computer (PC). Microcomputers are commonly used in homes, schools, banks, offices, etc. Microcomputers are available in various sizes like desktops, laptops and palmtops. A desktop computer is larger than a laptop and a palmtop and is required to be kept on

Microcomputer- Desktop Computer

the desk or table for use. Laptops and palmtops (or personal digital assistant, i.e., PDA) are small and compact. They are portable and can be taken from one place to another very easily. While using them, they can be kept on the lap and the palm. A laptop computer can be kept on lap for working. A laptop computer is also called a notebook computer. A palmtop can be kept on the palm while using. These portable computers have the backup power supply facility, so it can be used in places where there is no electricity. Dell, Apple, IBM, Sony, Toshiba, and Acer are some of the leading manufacturers of laptop computers.

ii. **Minicomputer**

A minicomputer is larger than a microcomputer. It is smaller than a mainframe and a supercomputer. A minicomputer is the mid-range server computer that consists of two or more processors. A minicomputer has more storage capacity and higher processing speed than a microcomputer. A minicomputer is a multi-user computer

that provides facilities to operate 100 people simultaneously via terminals (**A terminal is a device through a keyboard, mouse, monitor and other devices are connected to a computer**). Nowadays, minicomputers are mostly used as servers in the computer network. They are used for data processing, desktop publishing, etc.

iii. **Mainframe Computer**

A mainframe computer is a multi-user computer having faster processing speed and more storage capacity than a minicomputer. They are larger than minicomputers. They can support thousands of users through the terminals. Big organizations use mainframe computers for bulk data processing, financial transaction processing, etc. They are also used as central host computers in distributed data processing systems. IBM zSeries, FUJITSU Server GS21, Cray XE6,, Tianhe-1A, etc. are examples of Mainframe computers.

Mainframe - IBM Z16

iv. **Super Computer**

Supercomputers are the most powerful computers. They are the fastest and the most expensive. They have extremely large storage capacity and their processing speed is measured in FLOPS (Floating-Point Operations Per Second). They are used in areas like weather forecasting, automobile design, launching aircraft, etc. CRAY2, NEC SX-3, Deep Blue, etc. are the examples of supercomputers. In our country, Nepal, computer engineer, Muni Bahadur Sakya constructed a supercomputer in 2063 B.S. by joining sixteen microcomputers.

Supercomputer

1.4.2 On the Basis of Data Handling

On the basis of data handling, computers are classified in three categories as:

i.   Analog Computer

ii. Digital Computer

iii. Hybrid Computer

i.   Analog Computer

Analog computers are special-purpose computers (i.e., dedicated to a single task) that can measure continuous physical values like length, temperature, pressure, speed, height, vibration, etc., and convert them to numeric values. All operations on
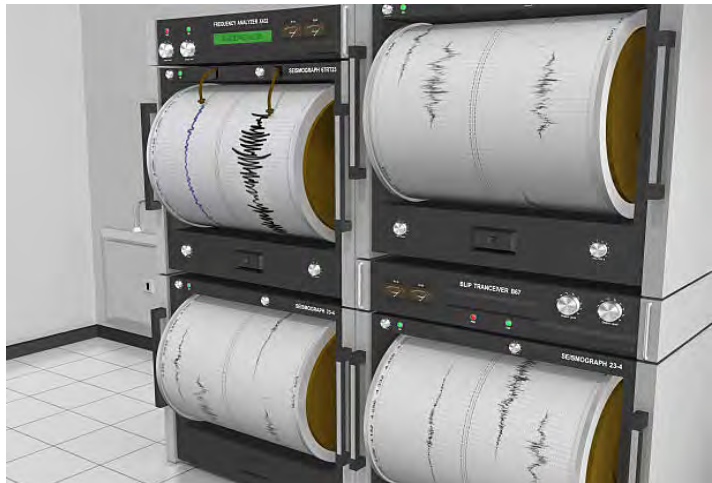
Analog Computer – Seismograph

the analog computer are performed in parallel. Speedometers and thermometers are examples of analog devices. The speedometer shows the speed of the vehicle while

it is moving. Analog computers are used for scientific and engineering purposes. Industries like power plants, petroleum refineries, and chemical plants use these computers. A seismograph is an example of an analog computer that measures an earthquake. In the ICU (Intensive Care Unit) of a hospital, the heartbeat, blood pressure, pulse, etc. of patients are monitored by analog computers.

ii. Digital Computer

Digital computers are general-purpose computers that work on binary digits. They accept discrete data (discontinuous data) like letters, numbers, symbols, and figures, and these data are represented in terms of binary numbers. Digital computers can't measure temperature, pressure, voltage, etc. Digital computers accept data and instructions, process them and give the information. Almost all the computers that we use in offices and homes are digital.

iii. Hybrid Computer

A hybrid computer has the capabilities of both analog and digital computers. It is the special-purpose computer. It accepts a continuously varying input which is then converted into discrete data for digital processing. They are used in aeroplanes, ships, factories, hospitals, and research centers. CT-Scan machine, ECG machines and Ultra sound machines are examples of

Hybrid Computer - Ultra Sound Machine

hybrid computers used in the health sector. Pathfinder is the hybrid computer that was sent to Mars.

1.4.3 On the Basis of Purpose

On the basis of purpose, computers may be special purpose computers or general purpose computers. A special purpose computer can handle only one particular data processing task efficiently. A general purpose computer can handle a variety of tasks. Most commonly used computers are general purpose computers.

1.4.4 On the Basis of Model

On the basis of the model, there are three types of computers. They are:

i.   XT (eXtended Technology) computer

ii. AT (Advanced Technology) computer

iii. PS/2 (Personal System-2) computer

i.   XT Computer

The computers having 8086 and 8088 microprocessors are XT (i.e., extended Technology) computers. IBM XT computer was launched in 1983 with an 8088 microprocessor, 10 MB hard drive and a 5.25 inch floppy disk drive. This XT computer was operated with PC-DOS 2.0 operating system. XT computers had a processing speed of 4.77 MHz. All XT computers were 8-bit system.

XT Computer – IBM XT

ii.   AT Computer

The computers having 80286, 80386, 80486 microprocessors are AT (i.e., Advanced Technology) computers. IBM launched the first AT computer in 1984 with the Intel 80286 microprocessor, 20 MB hard drive and 3.5 inch floppy disk drive. This AT computer was operated with PC-DOS 3.0 version. These AT computers had math co-processor chip, the Intel 80287 for faster calculations. AT computers were 16-bit, 32-bit or 64 bit system. They had a higher capacity than XT computers.

AT Computer - IBM 286 Computer

iii. PS/2 Computer

IBM launched the PS/2 or Personal System/2 computer in 1987 with micro channel architecture bus, VGA port, keyboard port, mouse port, etc. These computers are used for general-purpose. They can run application software like word processing, spreadsheet, database management, accounting package, and so on. The processing speed of these computers is higher than AT computers.

PS/2 Computer

1.4.5 On the Basis of Brand

On the basis of brand, there are three types of computers. They are:

i. IBM PC
ii. IBM Compatibles
iii. Apple / Macintosh

i. IBM PC

IBM is the largest computer manufacturing company established by Herman Hollerith in 1923 AD. All the computers manufactured by International Business Machine are IBM PCs. These computers are more reliable and durable. It is also called branded computer.

ii. IBM Compatibles

All the computers that are manufactured by other companies using the architecture designed by IBM are IBM compatible computers. It is made by assembling the parts of different companies. It is also called assembler computer. They are less expensive than IBM branded PCs.

iii. Apple/Macintosh

Apple Corporation is also one of the largest computer manufacturing companies in the USA. All the computers that are manufactured by Apple Corporation, USA are known as Apple/Macintosh Computers. Apple computer has different architecture design than IBM computer. In these computers, monitors and system units are attached to each other. They use different hardware and software. These computers

are mostly used in designing works.

Earliest Mac Computer	*Modern Mac Computer*

Exercise

Choose the correct answer from the given alternatives.

1. Which is not the characteristic of a computer?

   a. Speed   b. Accuracy

   c. Storage   d. Intelligence

2. The incorrect output due to the incorrect input is ……..

   a. GIGO   b. FIFO

   c. LIFO   d. GOGO

3. ….. byte (s) is required to store 4 characters.

   a. 8   b. 4

   c. 2   d. 1

4. ……….. is the feature of a computer that refers to the capability to perform tasks repeatedly.

   a. Versatility   b. Reliability

   c. Diligence   d. Intelligence

5. A computer that accepts the continuous value is known as ………computer.

   a. Lybrid   b. Hyper

   c. Analog   d. Digital

Write short answer to the following questions.

1. List the characteristics of a computer.

2. Why is a computer called diligent machine?

3. Why is a computer called versatile machine?

4. How are computers used in education sector?

5. How are computers used in health and medical sector?

6. How are computers used in banks?

7. Write the difference between desktop and laptop computers.

8. Write the difference between analog and hybrid computers.

Write long answer to the following questions.

1. Classify computers on the basis of their size and explain them in brief.
2. Classify the types of digital computers with short description.
3. Classify the computers on the basis of brand and explain them in brief.
4. Classify the computers on the basis of data handling and explain them in brief.

Practical works

1. Draw "Computer and its parts" on chart paper and demonstrate.
2. Make presentation on the "Features of computer".
3. Make presentation on the "Modern application of computer"
4. Conduct a speech competition on the topic 'Role of computer in education'.
5. Draw "Types of computers on the basis of working principle" on chart paper and paste in your class room.
6. Prepare a presentation about use and purpose of hybrid and supercomputer in different sector and demonstrate.

Activities

1. Conduct a presentation "Types of computers on the basis of purpose".
2. Conduct a presentation "Types of computers on the basis of size and data handling".
3. Conduct a presentation "Types of computers on the basis of mode and brand".

Computer Components

2.1 Introduction to Components of Computer

A computer consists of hardware and software. The hardware and software of a computer are integrated, and they work together to fulfill the commands of the user. Computer hardware is the physical component of a computer that can be seen and touched. A computer has different hardware components. Keyboard, mouse, monitor, microprocessor, hard disk, RAM, etc. are computer hardware. The components of a computer are classified into four units. They are the input unit, the output unit, the memory unit, and the processing unit.

2.2 Input Unit

A computer requires data and instructions to produce useful information. To enter data or instructions into a computer, input units are used. Input units are the components of a computer through which data or instructions are entered into the computer. It is the medium through which a user communicate with the computer. An input unit is also called an input device. A computer may have more than one input unit. Keyboard, mouse, joystick, touch screen, touchpad, scanner, digital camera, etc. are input units. When you enter data or instructions using input units, they convert the input data or instructions into computer-understandable form, i.e., binary form, and pass the binary form data or instructions to the computer for further processing. Some of the input devices can be discussed introduced below:

Keyboard

A keyboard is the basic input device that helps to input data or instructions into a computer. It consists of keys marked with alphabets, numbers, and some other characters. A user can input data like letters, text, numbers, and symbols through a keyboard. When a key on the keyboard is pressed, it generates the corresponding binary code of a character and sends it to the computer. The computer again converts the binary code back to the corresponding character and displays it on the monitor. For example, when an alphabet key 'A' is pressed, the keyboard generates binary code '01000001'.

A standard keyboard consists of 104 keys. A multimedia keyboard has more than 104 keys.

The keys on a keyboard are grouped into five different groups as:
- Alphabet keys
- Numeric keys
- Cursor-movement keys
- Functional keys
- Special purpose keys

Keyboard
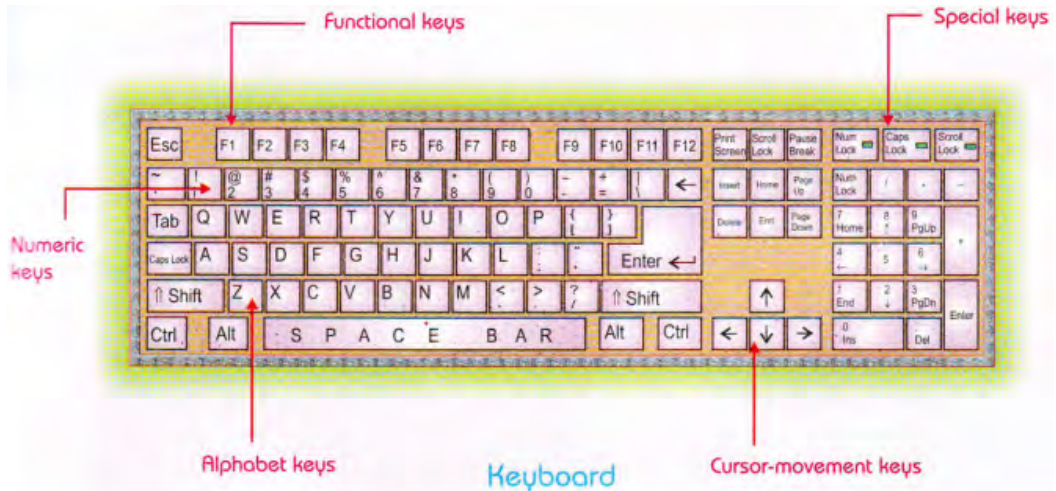
All keys marked with A to Z and punctuation symbols are alphabet keys. Keys marked with 0 to 9 and mathematical symbols are numeric keys. Keys marked with F1 to F12 are the function keys, and they are used for entering commands. Keys marked with arrow signs (←, ↑, →, ↓) are cursor movement keys (i.e., also known as arrow keys), and they are used to move the cursor in the specified direction. The Space bar, Enter key, Back Space key, Caps Lock key, Esc key, Ctrl key, Alt key, Shift key, Delete key, Home key, End key, and Insert key are the special purpose keys.

A keyboard performs the following tasks:
  a. It accepts or reads data and instructions from the user.
  b. It converts these inputs into a computer-acceptable form, i.e., binary code.
  c. It supplies the converted inputs to the computer system for further processing, which are stored temporarily in RAM.

Mouse

A computer mouse is a basic input device that allows a user to input data and commands displayed on the desktop or in the dialogue boxes by selecting them. It is a small handheld

input device that is used, especially in the graphic user interface (GUI), to point and select icons, data, and commands displayed on the screen. Since it points to icons, data, and commands displayed on the desktop, menus, or dialogue boxes, it is also called a pointing device. A computer mouse can be used to control the position of the cursor and point and select items on the screen, but it cannot be used to enter text into the computer like a keyboard.

A computer mouse may be a mechanical mouse or an optical mouse.

| *Mechanical mouse* | *Optical mouse* |

A mechanical mouse is not used nowadays. It consists of a plastic housing or casing with a flat bottom, a ball that projects through its bottom surface, and two push buttons and a scroll button on the top of the casing. When a mouse is moved, the ball moves in the direction of the mouse, which rotates a pair of wheels inside the mouse. The rotation of wheels generates electric signals that are sent to the computer system. The computer system converts the signals into the motion of the mouse pointer along the X and Y axes on the screen. The buttons are used to select an item on the monitor and to do other tasks. The left button works like the Enter key.

Nowadays, an optical mouse is common on a computer. It looks like a mechanical mouse, but instead of a ball and wheels, it uses a light-emitting diode (LED), optical sensor, and digital signal processor to detect the movement of the mouse.

Joystick

A joystick is a pointing device that is used to move the cursor on a screen. It has a stick that is attached to a square or rectangle plastic base with a flexible rubber case. The stick can be moved in all directions. A joystick has one or two buttons and a trigger. It is specially used for playing computer games.

Joystick

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OMR

Optical Mark Recognition is a special type of scanner that can recognize and count a pre-specified type of mark, such as checkmarks, bubbles, or boxes made on paper by pencil or ball pen. It reads and counts the marked data on the paper quickly and accurately. It is specially used for checking the answer sheets of examinations having multiple-choice questions.

| *Paper Marked with Pencil* | *Optical Mark Recognition* |

OCR

An Optical Character Reader (OCR) is a scanner that converts images or printed documents into digital images and transfers them to a computer. With the help of suitable OCR software like FineReader, the digital image can be converted into an editable document.

OCR may be handheld or flatbed. A handheld scanner is a portable scanner that can be held in a user's hand and can be moved over the document to be scanned. A flatbed scanner has a sheet of glass over which a photo or printed document to be scanned is placed.

| *Handheld Scanner* | *Flatbed Scanner* |

BCR

A Bar Code Reader (BCR) is an input device that reads data from a barcode, converts them

into alphanumeric values, and passes them to a computer. A barcode is a machine-readable representation of data. A barcode represents data in a set of vertical parallel lines of varying thickness with gaps. Books and goods in the markets are labelled with barcodes. When you scan a barcode with a bar code reader, the information like details of the product, price, etc., is passed to a computer system.

| Bar code | Bar code Reader |

MICR

A Magnetic Ink Character Reader (MICR) is an input device that is used in a bank to process a large volume of cheques and demand drafts. A cheque or demand draft is usually pre-printed with the bank's identification number and the customer's account number using a special ink containing iron oxide (magnetic ink). It reads the data written with magnetic ink on a cheque and transfers the information, like the bank's identification number, account number, amount, etc., to the computer system for immediate processing.

Magnetic Ink Character Reader

Scanner

A scanner is an input device that works more like a photocopy machine. It can scan and convert photos, printed text, handwritten documents, and drawings into digital images and transfer these digital images to the computer system. The digital images stored on a computer can be manipulated.

A scanner consists of two components: the first component generates the optical images of photos or other printed documents by illuminating them, and the second component converts the optical images into digital format and transfers them to a computer. The common optical scanner devices are Optical Mark Recognition (OMR), Optical Character Reader (OCR), and Magnetic Ink Character Reader (MICR).

Touch Screen

A touch screen is a special kind of device which works as an output device as well as an input device. It displays data or information on its display screen and enables a user to select and input data by touching on the screen with a finger. When a user touches the display screen of the touch screen of an electronic device, it senses the pressure of a finger and activates the commands. Nowadays, the touch screen is used in laptops, notepads, tablets, smart mobile, ATM, kiosks, etc.

Touch Screen - Kiosks

Touchpad

A touchpad is a touch-sensitive pad that is used in laptop and notebook computers in place of a mouse. It is also known as a trackpad. A touchpad works by sensing the user's finger movement and downward pressure. So, when a user moves his or her finger on the pad, the mouse pointer moves on the screen accordingly. To select the items on the screen, a user has to tap once and to open a file, a user has to tap twice quickly, just like a user has to do while using a computer mouse.

Touch Pad

Microphone

A microphone is an input device used for entering sound or voice into a computer. It is also called Mic, or Mike. It converts sound into an electrical signal and can be saved on a computer as a sound file. It is used for entering data and commands on a computer.

Microphone

Digital Camera

A digital camera is an input device that captures pictures or videos and stores them in digital format on its memory chip. It consists of an electronic photosensitive sensor that captures the photographs. The photos or videos stored in the digital camera can be viewed and erased immediately. The photos or videos from the camera can be transferred directly to the computer. Using suitable software, photos or videos on the computer can be edited according to the requirements.

Digital Camera

2.3   Output Unit

A computer user needs to see data and instructions being input through the input devices. A computer needs to present or display information being processed on it to a user. To display or present data, instructions, or information to the user, an output unit is used. An output unit is the component of a computer that displays or presents data, information, etc. to the user in human-understandable language. An output unit is also called an output device. Monitor, printer, speaker, plotter, projector, etc., are the output devices.

Output devices are categorized into:

   a)   Softcopy Output Device
   b)   Hardcopy Output Device

a)   Softcopy Output Device

   The output devices like the monitor, speaker, and projector are softcopy output devices. The output displayed or presented by these devices is not permanent. The information displayed on the monitor disappears as soon as you turn off the monitor. So, such an output device that presents or displays data or information in human-understandable language temporarily is known as a softcopy output device. The

output displayed or presented through a softcopy output device is known as softcopy. The softcopy lasts for a short time.

Monitor

A monitor is a softcopy output device that displays data or information being entered and processed on a computer. It is the basic output device of the computer that looks like a television. It is also called a Visual Display Unit (VDU). It can display text, images, videos, etc. temporarily on its display screen. The output displayed on the monitor is called the soft copy.

According to the display technology used in monitors, they may be Cathode Ray Tube (CRT) monitors or Flat Panel Display monitors.

CRT Monitor

LCD Monitor

A CRT monitor is based on the cathode ray tube technology. A CRT is an evacuated glass tube with an electron gun in its neck and a fluorescent-coated surface opposite the electron gun. The display screen of the CRT monitor is covered with tiny phosphor dots, which are called pixels (picture elements). The pixels on the monitor form images. So, the higher the number of pixels, the better the display quality. CRT monitors can be monochrome or color. A monochrome monitor can display text or images only in two colors (black and white colors). A color monitor displays text or images in millions of colors. A CRT monitor is bulky and heavy. It consumes more electricity.

Nowadays, flat-panel monitors are mostly used instead of CRT monitors. A flat-panel monitor is based on liquid crystal technology. In the flat panel monitor, liquid crystal molecules are placed between two electrode plates. When electrical current is applied on the electrodes, the electrodes determine and supply the different amount of electric current to the liquid crystal molecules and the crystal molecules form the image on the screen. To

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illuminate the image for users to see, flat-panel monitor uses the backlighting technology.

Liquid crystal display (LCD) monitors and light emitting diode (LED) monitors are flat-panel monitors. They both use a special kind of liquid crystal to form images. The only difference is their backlighting. In LCD monitors, compact fluorescent lamps (CFL) are used for backlighting, whereas in LED monitors, LEDs are used for backlighting. LCD monitors and LED monitors are both thin and lightweight, and they occupy less desk space. They consume less electricity. The LCD monitor and LED monitor can display pictures, text, and videos more clearly than the CRT monitors. Since LCD and LED monitors consume a lesser amount of electricity than CRT monitors, they are used in notebooks and laptop computers. LCD monitors are also used in desktop computers.

Nowadays, plasma monitors are also used on computers. A plasma monitor is a plasma display panel (PDP) monitor in which tiny cells containing noble gases and a tiny amount of mercury are placed between two pieces of glass. When electric charge is passed through the cells, the gases become ionized, turn into plasma, and emit ultraviolet light. This ultraviolet light strikes the inside of the glass panel, causing it to emit visible light, and images are formed. Plasma monitors can provide a larger, higher-resolution display with better colour reproduction than LCD and LED monitors. It is specially used for certain tasks, like photo editing or graphic design.

Speaker

A speaker is a softcopy output device that presents information in audio format. A speaker is needed to connect to the sound card of the computer. The sound card is the expansion card that translates digital signals into audio form.

Computer Speaker

Speakers are usually in a group of two and come in various sizes and shapes. You can listen to songs that are stored on the hard disk of the computer through the speaker.

Projector

A projector is a softcopy output device that is used for presenting information to many people at a time on a big screen. It can be used for projecting motion pictures in front of a large audience or at home.

Multimedia Projector
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Headphone

A headphone is a softcopy output device that contains a pair of small speakers. It is mounted on the head, and the speakers are positioned on the ears to listen to audio or voice privately without disturbing others.

Headphone

b) Hardcopy Output Device

The output devices like the printer and graphic plotter are hardcopy output devices. The output displayed or presented by these devices on paper is permanent. A printer presents information on a paper which lasts for a long time. So, such an output device that presents or displays data or information permanently is known as a hardcopy output device. The output produced by a hardcopy output device is known as a hardcopy. The hardcopy is permanent and can be reuse for a long time. The commonly used hardcopy output devices are printer and graphic plotter.

Printer

A printer is an output device that displays the data or information on the paper. There are mainly two types of printers. They are impact and non-impact printers.

Impact Printer

An impact printer uses pins like objects or hammers that strike on the inked ribbon, and characters are formed on paper. Impact printers physically strike the paper. Impact printers are slow and noisy. The printing quality of impact printers is low. Based on the printing technology used in impact printers, there are mainly three types of impact printers. They are Dot-Matrix, Daisy-Wheel and Line printers.

a. Dot-Matrix Printers

A Dot Matrix printer uses pin-like objects called a printer head. When the printer head strikes the inked ribbon, the impact of the hit forms dotted characters on the paper. Since the characters formed by dot matrix printers are in the patterns of dots, they are not fully formed characters. So, the printing quality of dot-matrix printers is not good. The more number of pins in

Dot Matrix Printer

the printer head forms closer dots on the paper, making the characters appear more fully formed and easier to read. Dot matrix printer heads may contain 9, 18 or 24 pins. While printing, dot-matrix printers produce noise. Dot matrix printers can print characters of any shape and size. They are durable and relatively economical to operate. The carbon copy can be produced by using a dot matrix printer. The speed of dot-matrix printers normally ranges from 50 to 400 characters per second.

b.   Daisy-wheel Printers

A Daisy Wheel printer uses hammer like objects to hit on the ink ribbon, and a character is formed at a time on paper. Every hammer contains a letter face and is arranged in wheel-like form. A motor spins the wheel at a rapid rate. When the desired character spins to the correct position, a printer hammer strikes on the
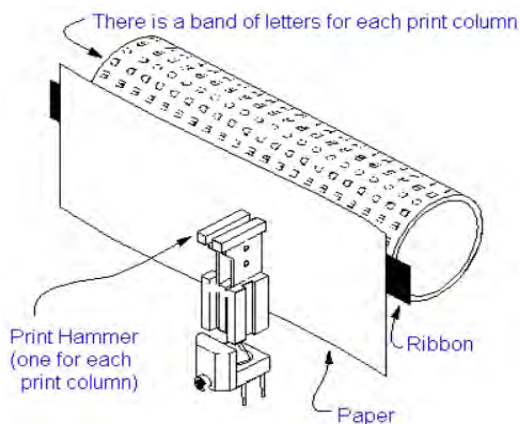

Internal parts of Daisy Wheel Printer

ribbon, which in turn strikes the paper, and output is formed on the paper. An entire character is formed by a single impact. Since the characters are carved on the tip of each hammer of the daisy wheel, daisy wheel printers cannot print images and characters of different sizes. The speed of Daisy wheel printers normally ranges from 10 to 50 characters per second.

c.   Line Printers

Line printers have a mechanism that allows multiple characters to be simultaneously printed on the same line. The mechanism may use a large spinning print drum or a looped print chain. As the drum or chain is rotated over the paper's surface, electromechanical hammers behind the paper push the paper (along with a ribbon) onto the surface of the drum

Line Printer - Internal Parts

or chain, marking the paper with the shape of the character on the drum or chain.

Line printers are much faster than dot-matrix or daisy-wheel printers. The speed of a line printer is measured in lines per minute (LPM), and the speed may be 200 to 3000 lines per minute. They are noisy and have poor printing quality.

Non-impact printers

Non-impact printers (laser printers or inkjet printers) do not strike on the paper with pins like objects to form characters or images on the paper. They use laser beam technology or bubble jet technology. They do not produce noise while printing. The printing quality of non-impacts is good, but they are a little bit costly to operate. These printers can also print high quality photos.

a. Laser Printer

A laser printer does not use pins like object to form characters or images on paper. A laser printer is an electrophotography printer that uses a laser beam to produce an image on a drum. The drum is coated with a photosensitive plastic, which is given a negative electrical charge over its surface. The light of the laser alters the electrical charge on the drum wherever it hits. That means wherever the laser light hits on the drum surface, it gets positively charged. The drum is then rolled through a reservoir of toner (i.e., negatively charged ink powder), which is picked up by the positively charged portions of the drum. Finally, the toner is transferred onto a piece of paper and fused to the paper with heat and pressure. After the document is printed, the electrical charge is removed from the drum, and the excess toner is collected.
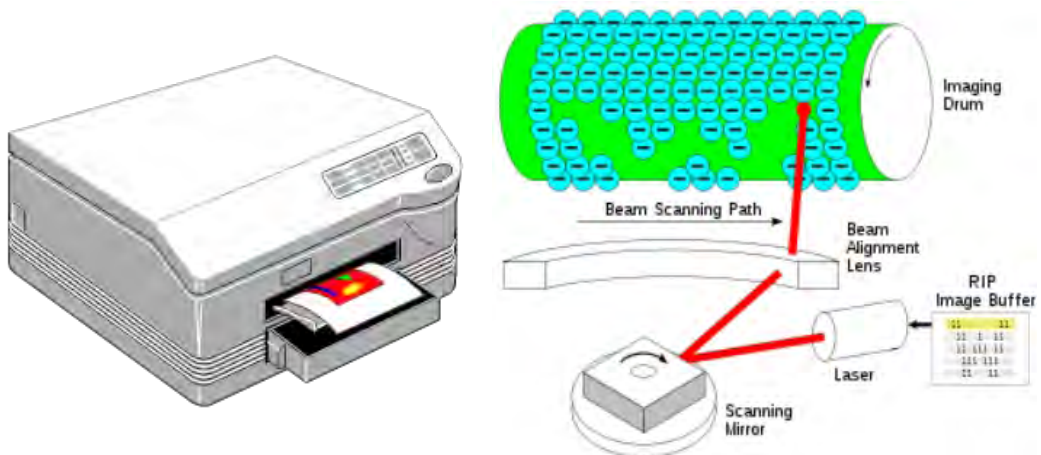
Laser Printer   *Showing formation of image*

The resolutions of laser printers range from 300 dpi to 1,200 dpi. Laser printers produce very high-quality prints and are capable of printing any shape or size of text or graphics. Laser printers are much quieter than dot-matrix or daisy-wheel printers. They are also relatively fast. They can print 6 to 200 pages per minute. The speed of laser printers ranges from about 4 to 20 pages of text per minute (ppm). A typical rate of 6 ppm is equivalent to about 40 characters per second (cps).

b.   Inkjet Printer

Inkjet printers are non-impact printers that form images on paper by spraying a stream of ink drops onto the paper. An inkjet printer consists of a print head and ink cartridges. The print head contains a series of nozzles that are used to spray drops of ink. Depending on the manufacturer and model of the printer, ink cartridges come in various combinations, such as separate black and color cartridges, color and black in a single cartridge or even a cartridge for each ink color. The cartridges of some inkjet printers include the print head itself.

Different types of inkjet printers form their droplets of ink in different ways. Two main inkjet technologies are currently being used by printer manufacturers:

Manufacturers such as Canon and Hewlett Packard use thermal bubble technology, commonly known as **bubble jet**. In a thermal inkjet printer, tiny resistors create heat, and this heat vaporizes ink to create a bubble. As the bubble expands, some of the ink is pushed out of a nozzle onto the paper. When the bubble "pops" (collapses), a vacuum is created. This pulls more ink into the print head from the cartridge. A typical bubble jet print head has 300 or 600 tiny nozzles, and all of them can fire a droplet simultaneously.

Manufacturers such as Epson use Piezo electric technology. This technology uses piezo crystals. A crystal is located at the back of the ink reservoir of each nozzle. The crystal receives a tiny electric charge that causes it to vibrate. When the crystal vibrates inward, it forces a tiny amount of ink out of the nozzle. When it vibrates out, it pulls some more ink into the reservoir to replace the ink sprayed out.

Inkjet printers can print any shape or size of text and graphics. The colour inkjet printers can print high quality photos. An inkjet printer can print 6 to 12 pages per minute.

3D Printer

A 3D printer is a special type of printer that can create 3D objects based on digital models. It uses layering and slicing to produce tangible, solid 3D objects, typically of plastic or resin.

3D Printer

Graphic Plotter

A plotter is a hardcopy output device like a printer. It is specially used to print big size of graphs, engineering drawings, posters etc. Plotters are basically of two types: one that uses pens and others that do not use pens. Drum and flatbed plotters both use pens. Electrostatic plotters do not use pens. In a drum plotter, the paper is placed on the surface of a drum. The drum revolves and the plotter pens are horizontally positioned over the target area. When the paper has rotated to the correct point, the pens are dropped to the surface and moved left and right under program control across the paper as the drum revolves. When the image is completed, the pens are raised from the surface.

Plotter

Flatbed plotters are designed so that the paper is placed flat and one or more pens move horizontally and vertically across the paper.

Electrostatic plotters use electrostatic charges to create images out of very small dots on specially treated paper. The paper is run through a developer to allow the image to appear. Electrostatic plotters are faster than pen plotters and can produce images of very high resolution.

2.4 Concept of Memory Unit

The memory unit or primary memory (RAM) is the part of the computer where instructions (program) and data to be used by the computer are stored temporarily. The data and instructions entered through the input device are transferred to primary memory. Data and programs from a secondary storage are also transferred to the primary memory whenever they are needed to be used. From the primary memory, data are forwarded to the ALU for further processing, and the processed data (information) is returned back to the memory unit. From the memory unit, these processed data are passed to the output

unit or secondary storage unit. So, the primary memory is the working space where unprocessed data, instructions or currently running programs and processed data are temporarily stored.

The functions of the primary memory unit are as follows:

    a.   It stores all the data to be processed and the instructions required for processing.

    b.   It stores intermediate results of processing.

    c.   It stores final result of processing before these results are transferred to an output unit or secondary storage.

    d.   It stores currently running programs.

2.5 Processing Unit

The main component of the processing unit is the microprocessor. It is the part of the computer system that interprets and executes program instructions. It works with an operating system and executes a set of instructions and controls different peripheral devices by sending and receiving control signals. The microprocessor controls the flow of data by directing the data to enter the system, placing data in the memory, sending the data to the ALU for processing, and directing the output of information.

Microprocessor

A microprocessor is an integrated circuit formed on a single chip that executes instructions and carries out arithmetic and logical operations. So, it is known as the brain of the computer. The circuitry of a microprocessor contains millions of tiny electronic components. The capability of a microprocessor increases as the number of electronic components in the microprocessor increases. More electronic components deposited on a single chip means more number of instruction sets in it. The instruction set of a microprocessor contains all the commands or instructions that it can understand and work on.

Intel 4004   *Intel 7*   *Ryzen 7*

The first microprocessor ,'Intel 4004', which was developed by Marcian Ted Hoff of Intel Corporation in 1971 AD, contained 2300 transistors. The Intel 4004 could execute only

a few instructions and manipulate only tiny amount of data at a time. The new Pentium microprocessor contains more than 3.3 million transistors. The speed of a computer depends mainly on its microprocessor. The microprocessor has three main parts.

    a. Control Unit (CU)

    b. Arithmetic Logic Unit (ALU)

    c. Registers

All these work together to process the computer's data.

❖ The Control Unit controls the working of all parts of a computer. It controls the movement of data inside as well as outside the CPU. It communicates between registers and the ALU and between the CPU and all the input, output, and storage devices. It directs all the parts of the computer system to perform their tasks.

❖ The Arithmetic Logic Unit (ALU) performs all arithmetic operations like addition, subtraction, multiplication, division, and logical operations like greater than, less than, not equal, etc.

❖ Registers are small memory units used to store immediate data, instructions, and results while processing data.

Function of Microprocessor

The basic task of a microprocessor is to input the instructions from the memory, decode and process them, and produce the output. It performs three basic tasks while processing the information. They are as follows:

1. Performing some basic calculations using the ALU for example, addition, division, multiplication, subtraction, etc.

2. Moving data from one location to another.

3. It has a Program Counter (PC), which is a pointer that stores the address of the next instruction. It keeps track of the PC and performs instructions accordingly.

Characteristics of Microprocessor

The three main characteristics of a microprocessor are: clock speed, word length and instruction set.

Clock Speed

The clock speed refers to the speed at which the microprocessor executes each instruction. The microprocessor requires a fixed number of clock speed to execute each instruction. The

clock speed is also called CPU frequency or processor speed. The CPU speed determines how many instructions it can perform in one second of time. Basically, clock speed is the number of cycles that the processor executes per second. The higher the speed, the more calculations it can perform, thus making the computer faster. Clock speeds are measured in megahertz (MHz), or gigahertz (GHz). One MHz represents 1 million cycles per second and one GHz represents 1 billion cycles per second. A dual-core 3.0 GHz processor would be capable of performing double the number of calculations as a single-core 3.10 GHz processor. To know the processor speed of a computer, press the Windows key and the Pause key at the same time. It opens the system window like below:
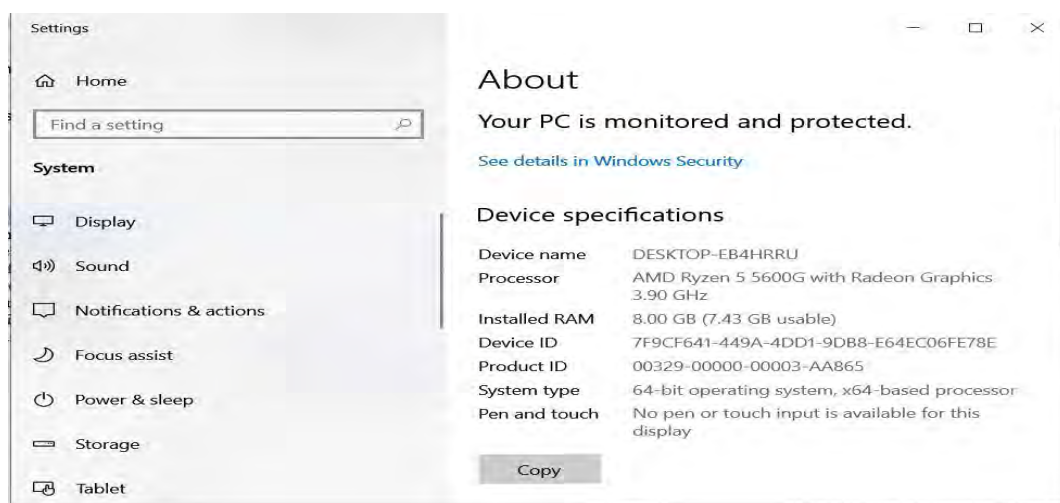
Word Length

Word length (i.e., word size) is the number of bits that a processor can process in a single instruction. Furthermore, the word size determines the amount of RAM that the processor can access at a time. Moreover, it also decides the number of input and output pins on the microprocessor. These pins are used to decide the architecture of the processor.

The number of input and output pins is always equal. For example, the first commercial processor, Intel 4004, was a 4-bit processor. Hence, it has four input/output pins. Now a days, mostly 32-bit or 64-bit are used.

Instruction Set

An instruction is a command that tells the computer to operate on some piece of data. The set of machine-level instructions that a microprocessor executes is the instruction set.

Choose the correct answer from the given alternatives.

1.   Which is not the input device?

   a. Keyboard   b. Joystick   c. Plotter   d. Digital camera

2.   An input device that is used special for playing computer games ……………

   a. Mouse   b. Touch pad   c. Joystick   d. Microphone

3.   Two million cycles per second is ………...

   a. 1 GHz   b. 2 GHz   c. 2 MHz   d. 1MHz

4.   ……… printer that can print a digital model into a tangible and solid object.

   a. Graphic Plotter   b. 3D printer   c. Laster printer   d. Inkjet printer

5.   Which is an impact printer?

   a. Dot-matrix printer   b. Laster printer

   c. Inkjet printer   d. None of the above

Write short answer to the following questions.

1.   Write the uses of keyboard and mouse.

2.   List any four input devices.

3.   Write the uses of OMR, Joystick and BCR.

4.   What is output device? List any two output devices.

5.   What is a printer? List the types of printers.

6.   What is impact printer? List its types.

7.   What is non-impact printer? List its types.

8.   What is microprocessor? Write its major parts.

9.   Write the functions of CU and ALU.

10.   What is monitor? Explain its types.

Write long answer to the following questions.

1.   Write the difference between impact and non-impact printers.

2.   Write the difference between softcopy output device and hardcopy output device.

3.   Define computer hardware. List any two input and output devices.

Project works

1. Describe computer system and its main unit by using power point presentation and demonstrate.
2. Prepare a presentation about "CPU is also known as brain of computer system" and demonstrate.
3. Prepare a presentation about different hardware found in computer lab and demonstrate.
4. Draw a chart paper about different types of computer hardware with name and paste in your class room.
5. Visit IT solution office such as computer maintenance center and sales, and collect the latest available devices.

3.1   Introduction to Computer Software

A computer is made up of hardware and software. The computer hardware can work only when they get data and instructions. A set of instructions given to a computer to perform some tasks is known as a program. Computer cannot perform any task without programs. The program defines the instructions that a computer has to carry out. A program tells a computer what to do and how to do. Computer program directs a computer how to process and execute data. A collection of programs that operates and controls computer hardware or performs specific tasks is known as software. Software is non tangible part of computer that you can't touch or feel. It makes the computer hardware to perform tasks. It guides the computer at every step where to start and stop during a particular task. It increases the capabilities of the hardware. Software and hardware are complementary to each other. Both have to work together to produce meaningful output.
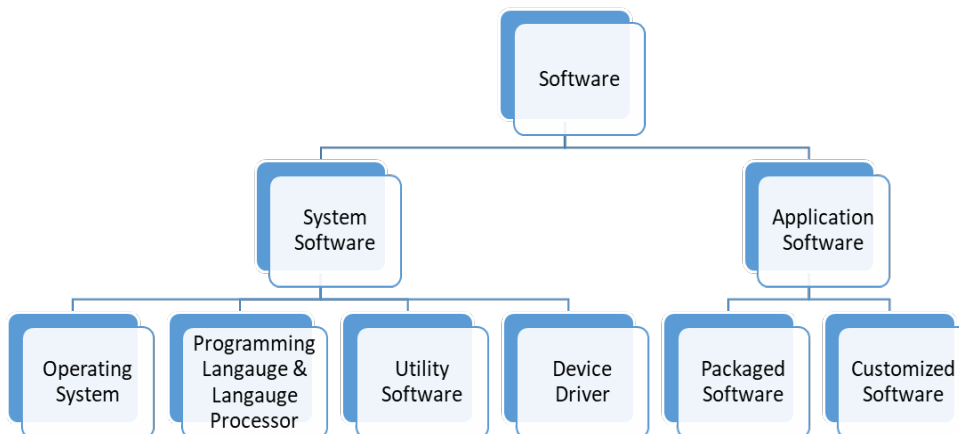
Microsoft Windows XP, Microsoft Windows 7, Microsoft Windows 8, Windows 10/11, Linux, Unix, Novell Netware Server, Microsoft word, Microsoft PowerPoint, Microsoft Excel, VLC media player, Microsoft media player, Adobe Photoshop, Android, MacOS, etc. are computer software.
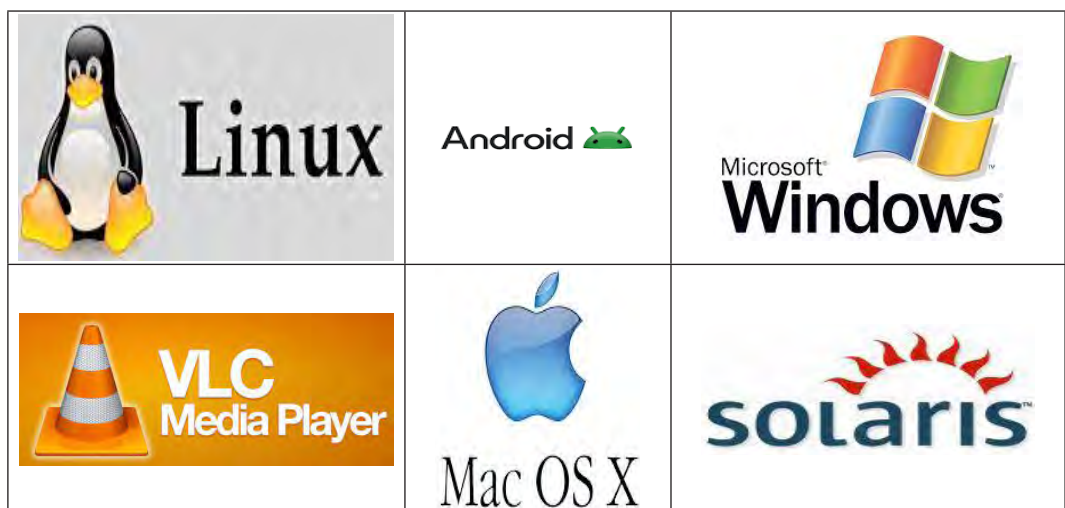
3.2   Type of Software

There are mainly two types of software.

a)   System Software

b)   Application software

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                          ┌──────────────┐
                          │   Software   │
                          └──────┬───────┘
                 ┌───────────────┴───────────────┐
          ┌──────────────┐                 ┌──────────────┐
          │   System     │                 │ Application  │
          │   Software   │                 │   Software   │
          └──────┬───────┘                 └──────┬───────┘
    ┌────────┬───────┼────────┐            ┌──────┴──────┐
┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐┌────────┐
│Operating││Programming││Utility ││Device  ││Packaged││Customized│
│System  ││Langauge & ││Software││Driver  ││Software││Software │
│        ││Langauge   ││        ││        ││        ││         │
│        ││Processor  ││        ││        ││        ││         │
└────────┘└────────┘└────────┘└────────┘└────────┘└────────┘
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System software is a set of programs that is designed to control the operations of a computer system. The system software helps computer hardware to work together. It controls and manages all internal operations like reading data from input devices, transferring information to output devices, checking the components of a computer, etc. System software is essential for the development of applications software. System software provides environment for application software in order to run on the computer. So, system software is software that is designed to run computer hardware and application software.

Features of System Software

System software is the low level software that has the following features:

*   It provides effective platform for higher-level software to operate on the computer system.

*   It is developed using the low level languages to control and manage computer hardware.

*   It links the computer hardware and provides functionality to hardware.

*   It provides the user interface to interact with computer hardware and application software.

*   It runs in the background and manages all functioning of the computer itself.

*   It manages all the essential functions of a computer.

System Software may be:

a) Utility Software

b) Device Drivers

c) Programming Language and Language Processor

d) Operating System Software

Utility software is the helpful software that performs specific tasks related to the maintenance of computer hardware and data. It helps to keep a computer in the smooth functioning condition. It provides facilities for performing tasks like transferring data and file, recovering lost data and file, searching and removing computer viruses, disk management, etc. Backup software, Download Accelerator (DAP), SplitFile, Anti viruses, WinZip, WinRaR, Disk Defragmenter, Registry Cleaner, HistoryCleaner, CClearner, etc. are some examples of utility software.

| *WinRaR* | *CClearner* | *Avira Antivirus* |
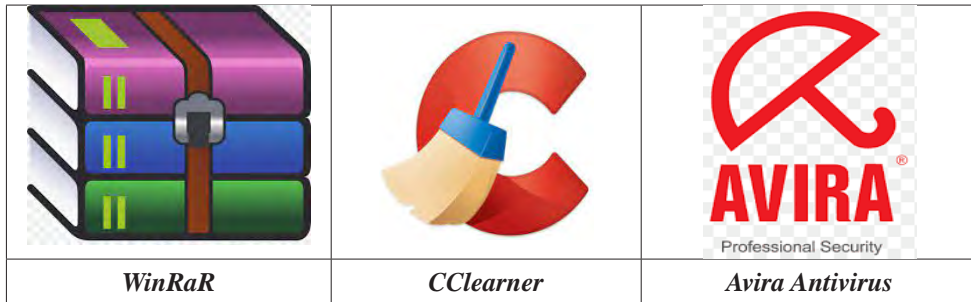
A device driver is a set of programs that is designed to control and manage the specific device. The device drivers make the devices usable. Every device or hardware like printer, sound card, display card, etc. has its own device driver. Suppose you have brought a new printer and to use the printer, you have to first install the device driver of the printer.

A programming language is the system software that allows a programmer to write software. Low Level Language and High Level Language are two types of programming languages.

A language processor (also called translator) is system software that translates programs written in assembly language or high level language into machine language. Assembler, interpreter and compiler are three types of language processors.

An operating system is the basic system software that controls and manages the overall operation of a computer.

Application Software

Application software is the specific software that is designed to fulfill the requirement of people. It can perform specified tasks such as handling financial accounting, processing words, preparing exam result, producing bills, manipulating images and videos, etc. Application software does its tasks with the help of operating system. Packaged Software and Customized (or Tailored) Software are two types of application software.

Packaged software is the readymade software developed for all general users to perform their generalized tasks. Software companies like Microsoft, Adobe, Dropbox, Corel, Oracle, Google, etc., use to develop packaged software. MS-Office, Adobe InDesign, Sybase, SQL Server, Oracle, CorelDraw, Adobe PhotoShop, 3DS Max, Maya, VLC Media Player, Google Meet, Zoom, Spotify, etc. are packaged software.

Customized (Tailored) software is the application software which is designed to fulfill the specific requirements of an organization, office or individual. It is useful for the organization, office or person for whom it is developed. SEE Result Processing Software, Hospital Management Software, School Management Software, Bill Processing Software, Air Ticket Reservation Software, Banking Software, etc. are customized software.

Features of Application Software

• Application software is a user-friendly software that enables a user to perform his/her tasks easily.

• It increases the productivity of a user.

• It provides facilities to customize settings, preferences and other options to meet users' specific needs.

• It enables users to perform their tasks in more organized and efficient ways.

Uses of Application Software

Application software are used in almost all the sectors in our lives. Some uses of application software are listed below:

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- **Communication:** Application software like Skype, WhatsApp, Viber, Messenger, etc., are widely used in real time communication in our day to day lives to communicate with friends and family from anywhere in the world.

- **Documentation:** Application software like Microsoft Word, InDesign, Google Docs, etc. are widely used to prepare simple to complex documents.

- **Database:** Application software like Microsoft Access, Sybase, SQL Server, etc. are used to manage databases of people.

- **Spreadsheet:** Application software like Microsoft Excel, Google Sheet, etc. allows a user to manage financial information.

- **Entertainment:** Microsoft media player, VLC player, Spotify, Netflix, YouTube, etc. enables users to entertain themselves listening songs or watching videos.

- **Information:** Web browsers like Google Chrome, Mozilla Firefox, Safari, etc., enables users to access information on the Internet.

Difference Between System and Application Software

System Software	Application Software
• System software manages basic system resources and processes.	• Application software performs specific tasks to fulfill user needs.
• System software runs in the background and users do not usually access it.	• Application software runs in the foreground and users works directly with it to perform specific tasks.
• System software is the basic need of a computer. Without it a computer cannot run.	• An application software is required when the specific task has to be performed on a computer.
• System software provides a platform for other software.	• Application programs are designed to perform tasks and activities for the users.
• System software helps to run application software	• Application software cannot run independently without system software.
• Low level languages (assembly language) and middle level language (C) are used to create system software.	• High level languages like C++, Java, .Net, VB, etc., are used to create application software.

3.3   Introduction to Operating System

Operating system software is the system software that controls and manages the overall operation of a computer just like a traffic policeman controls the traffic on the road. It is the basic requirement of a computer. It is the first software that is loaded into the computer memory (RAM) when you switch a PC on and works till you shut down the computer. It controls hardware and application software. It acts as an interface between the user and the computer or between the software and the hardware. It makes hardware usable in computer and provides environment to software and users for doing their tasks. It provides the environment in which you interact with a computer and application software. It is responsible for the smooth and efficient operation of the computer system. Without operating system in a computer, we cannot operate the computer. Microsoft Windows OS, Macintosh OS X, Fedora, Ubuntu, Android, IBM OS/2, UNIX and LINUX are some examples of operating systems.
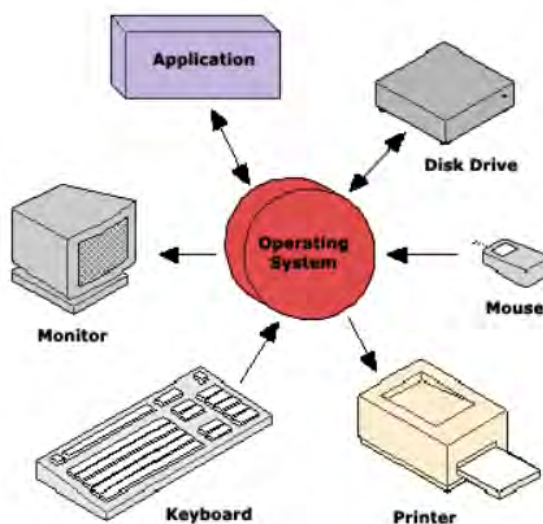
3.4   Function and Characteristic of Operaing System

The main functions of an operating system are given below:

a. It controls and manages the hardware present in the computer like microprocessor, input and output devices, storage devices, etc.

b. It manages computer memory (RAM). It assigns the memory to various programs when required and then makes the memory free after the program is not in use.

c. It manages files of application programs on a variety of storage media. It performs

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file related operations such as copying, deleting, moving, and so on.

d. It manages software resources of the computer system.

e. It creates the environment to run other software like MS-Word, MS-PowerPoint, Macromedia Flash, etc.

f. It notifies the user about system errors or errors that encounters during program execution.

The main characteristics of an operating system are given below:

- **Multitasking**: Operating system has the ability to perform multiple tasks or processes simultaneously. This means you can open and work on multiple applications at the same time.

- **Multi-user:** Operating systems also allow multiple users to access the same machine at the same time. Each user has their own account and custom settings.

- **Memory Management:** Operating systems are responsible for managing system memory, allocating and releasing resources as necessary. This ensures efficient memory usage and avoids conflicts between applications.

- **Resource Allocation:** An operating system should allocate system resources fairly so that each process gets access to the resources it needs to function correctly. It should also allocate resources dynamically, based on the current system load and user demand.

- **File System:** Operating systems provide a file system that organizes and manages the information stored on the hard drive. This allows users to save, access and manage their files efficiently.

- **Graphical User Interface (GUI):** GUI is the visual interface that allows users to interact with the operating system and applications intuitively. Provides graphical elements such as icons, windows and menus to facilitate navigation and use of the system.

- **Device Drivers:** Operating systems include device drivers that allow communication between hardware and software. These drivers are essential for the operating system to correctly recognize and use the devices connected to the computer.

- **Fault Tolerance:** An operating system is designed in such a way that it is able to handle hardware and software failures and performs error detection and recovery mechanisms in order to minimize system downtime and data loss.

- **Compatibility:** An operating system is compatible with a wide range of hardware

and software devices, allowing software applications to run on different hardware platforms.

- **Security:** An operating system provides security features like protection against unauthorized access, file encryption of sensitive data, firewalls, and antivirus software. It also provides features like backup and recovery to ensure data availability in case of data loss or system failure.

- **Updates and Patches:** Operating systems regularly receive updates and patches to fix bugs, improve performance and add new features. These updates are important to keep the system secure and up to date.

3.5   Types of Operating System

According to the number of users, operating systems are classified into two types. They ar following:

a.   Single User Operating System

A Single User Operating System is designed to manage a computer so that only one user can work on it at a time. Microsoft Windows XP, Window 7, Windows 8 and Windows 10/11 are some example of Single-User Operating Systems. A single user operating system like MS-DOS allows the user to perform one task at a time whereas Windows based operating system allows the user to perform multiple tasks at a time.

b.   Multi User Operating System

A Multi User Operating System allows more than one user to access and share the computer system at the same time. UNIX, Windows NT, Windows 2000 Server, Novell Netware, etc. are examples of Multi User Operating Systems.

3.6   User Interface

The user interface is something through which a user interacts with a computer. Graphic User Interface (GUI) and Character User Interface (CUI) are two types of user interfaces. The GUI is such type of interface where a user interacts with a computer by selecting the graphics. Icons, navigation bars, images, etc. that appeared on the Desktop are graphics. In GUI, a mouse can be used to select the icons or commands. In this GUI, a user does not need to remember commands to perform tasks. A user can simply select and enter the commands with the help of graphics. It is a very user-friendly interface. All Windows based operating system is GUI.

The CUI (also called CLI, i.e., command line interface) is a text-based user interface where a user interacts with a computer by entering a textual commands through a keyboard. To perform any action a command is required. So a user has to remember all the commands and their syntaxes to apply them.

Character User Interface	Graphic User Interface
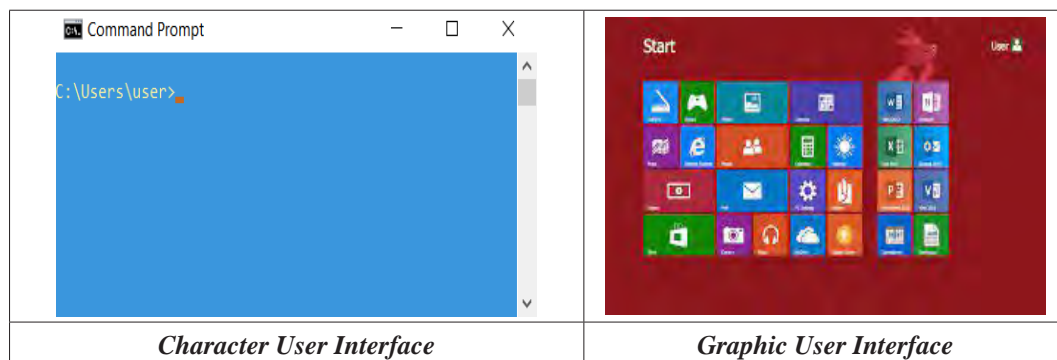
According to the interface, operating systems are classified into two types:

a.   Command Line Interface (CLI) Based Operating system

In CLI based operating system, users are required to type commands to perform any task. MS-DOS and Novell Netware are *CLI based operating system*.

b.   Graphical User Interface (GUI) Based Operating System

In GUI based operating system, icons, buttons, dialog boxes, etc., are provided to interact with the computer. Windows families of operating systems like Windows 95, Windows XP and Windows Vista are *GUI based operating system*.

3.7   Open Source Software

Based on the accessibility of source code of software, there are two types of software. They are Open Source Software (OSS) and Closed Source Software (CSS).

The open source software is a type of software that allows its source code to be publicly accessible. It means anyone can view, modify and use the code freely. Linux, Apache, Audacity, OpenOffice, Android and others are open source software.

The close source software (also called proprietary software) is a type of software that does not allows its source to access by any others except the creator or the authorized organization. The CSS usually comes with a license, and users are required to purchase the software to use it. This leads to higher costs and restrictions on the modification and usability of the software. Windows OS, Adobe Photoshop, iTunes,

Microsoft Office Suite, AutoCAD, and many others are CSS.

Difference between OSS and CSS

Open Source Software	Closed Source Software
• It is commonly known as OSS.	• It is commonly known as CSS.
• The source code is public and open to all.	• The source code is closed and protected from public access.
• The code can be freely modified by any user or organization.	• Only the creator or the authorized organization can modify the code.
• OSS is usually free or low-cost.	• CSS is generally more expensive due to licensing fees.
• Minimal to no restrictions on the modification or usage of the software.	• Users are bound by license agreements that restrict software modification and usage.
• Programmers often compete for recognition in the open-source community.	• Recognition of programmers is usually within the organization.
• All programmers can suggest improvements, which are incorporated if approved by the software developers.	• Only hired programmers within the organization can suggest improvements.
• A large OSS project may involve numerous programmers working in teams.	• The team size in a CSS project is usually limited.
• The source code is included with the software purchase.	• The software can be purchased without the source code.
• OSS can be installed on any device.	• A valid license is required to install CSS on a device.
• OSS is known for quick error detection and resolution.	• CSS provides robust error handling and prevention mechanisms.
• Responsibility for OSS is not assigned to any specific individual or organization.	• The vendor is responsible for the CSS.
• Linux, Apache, WordPress, Drupal, Audacity, WPSOffice, etc.	• Windows OS, Adobe Photoshop, iTunes, Microsoft Office Suite, AutoCAD, etc.

Exercises

Choose the correct answer from the given alternatives.

1.   Which is of the following the operating system?

    a. Android   b. Windows 10

    c. Linux   iv. All of the above

2.   System software ……….

    a. controls the operation of a computer

    b. provides the environment to run other software

    c. links a user, hardware and application software.

    d. All of the above

3.   An utility software ……………

    a. helps to keep a computer in the good working condition.

    b. transfers data from a hard disk to RAM.

    c. links hardware and software.

    d. controls computer hardware.

4.   ……… is an application software.

    a. Microsoft Word   b. Windows 10

    c. Linux   d. All of the above

5.   ……… manages computer memory (RAM).

    a. Device driver   b. Utility software

    c. Application software   d. Operating system software

Write short answer to the following questions.

1.   What is system software? List its four features.

2.   List the types of system software?

3.   Why does a computer need an operating system?

4.   What is application software? List its types.

5.   Write the differences between packaged software and customized software.

6.   List the features of application software.

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7. Write the uses of application software in our daily lives.

8. Write the difference between system software and application software.

9. Write the difference between GUI and CUI.

Write long answer to the following questions.

1. What is operating system? Explain its functions.

2. What is user interface? Explain its types.

3. What is open source software? Write the differences between open source software and closed source software.

4. What is system software? Explain its types.

5. What is application software? Write its uses.

Practical works

1. Draw "Classification of software" on chart paper and demonstrate it.

2. Make presentation on the "Operating system".

3. Make presentation on the "Application software"

4. Conduct a speech competition on the topic 'Role of OSS'.

5. Make a presentation of system, application and utility software used in your computer lab.

6. Prepare a presentation and demonstrate about open source software that you are familiar with and list its features.

Project works

1. Collect names of software used in hospital, hotel, educational sector and other different sector surrounding you and group discussion about main objectives of these software.

2. Take a short interview with your teachers, friends, parents and relatives and prepare a field report about what types of computers, laptops or other devices they are using, what types of operating system the device install. Also make a list of apps that they have used in their smart phones.

Memory/Storage Unit

4.1. Memory Defination

In a computer system, when you give it data and instructions to work with, it needs a place to keep them temporarily while it works on them. This temporary storage space is called a primary memory and includes things like cache, RAM, and registers. Once the computer processes the raw data, it turns it into useful information. This useful information needs to be kept for later use, so we use storage devices like hard disk, solid state disc, pen drive, etc., to store it. A storage device that stores data, instructions, etc., permanently is known as secondary memory. A primary memory is where data and information are stored temporarily, while secondary memory is where they're kept for a longer time.

Memory is made up of many tiny cells, each capable of holding a bit of information. These cells are organized into groups called words, which have addresses assigned to them. When the computer needs to work with data or instructions, it uses these addresses to find them in memory. The speed at which the computer can find these addresses affects the cost of the memory i.e., if it's faster, it's usually more expensive.

Memory is the storage location where we can store data and information, either temporarily or permanently. The units of measurement of memory in a computer are bits, KB, MB, GB, etc. The storage unit of data and information on a computer is as:

Unit	Measurement
0,1	Bits
4 bits	1 Nibble
8 bits	1 Byte
1024 Byte	1 KB
1024 KB	1 MB (Mega Byte)
1024 MB	1 GB (Giga Byte)

| 1024 GB | 1 TB (Tera Byte) |
| 1024 TB | 1 PB (Peta Byte) |

Necessity of Memory in Computer

A computer needs memory for holding data and instructions permanently or temporarily. Computer memory is the electronic holding place for the instructions and data. It is the place where information or instructions are stored for immediate use. Memory is one of the basic functions of a computer, because without it, a computer would not be able to function properly. Memory is also used by a computer's operating system, hardware and software.

4.2. Types of Memory

A computer memory is used for storing various types of data and information. There are different types of memory for storing data and information. Some memory stores data temporarily and some stores permanently. Some memories communicate directly with CPU where as some communicate indirectly with computer system. The overall classification of computers can be done in two types:

a. Primary Memory and

b. Secondary Memory

4.3. Cache Memory

A computer stores currently opened program, data, instructions, etc. into temporary memory, i.e., RAM. There are some data and instructions that are frequently needed by the CPU. RAM takes more time to provide these data and instructions to the CPU, which makes CPU execution slow. To speed up the CPU execution speed, cache memory is used. The cache memory holds the frequently needed data and instructions by the CPU.

The high speed memory between the RAM and the CPU is known as cache memory. The cache memory is used to store frequently accessed data and instructions during the time of processing by the CPU. It is the high speed volatile memory available to the processor for fast processing. The storage size of cache memory is small. If the CPU requires any data, it first searches data in the cache memory, if it finds data, it takes and processes it. This process is called cache hit. If data is not found in the cache memory; it is called cache miss. So, the CPU looks for data in RAM and loads it into the cache memory. The main importance of cache memory is to make CPU

execution faster. There are different levels of cache memory. L1, L2, L3 (Level 1, Level 2, Level 3). The higher the numbers of levels, the faster is the cache.

Importance of Cache memory

- It stores frequently accessed data by the CPU.
- It speeds up execution speed of the CPU.
- It acts as buffer between a processor and RAM.
- It improves performance of the CPU.

4.4. Primary/Main Memory

Primary memory, also known as the main memory or internal memory of a computer system, serves as the core storage component. It can be categorized as either temporary or permanent. Compared to secondary memory, primary memory has a relatively limited storage capacity. Its primary function is to temporarily store data and instructions during processing. Acting as the memory directly accessible by the CPU, primary memory facilitates the processor's interaction with running applications and services stored temporarily in specific memory locations. Upon booting up, primary memory loads all active applications, including the operating system, user interface, and background programs. Whenever a program or application initiates within the computer system, it is loaded into primary memory to interact with the operating system. Common types of primary memory include RAM, ROM, cache memory, and virtual memory.

4.4.1. Characteristics of Main/Primary Memory

The following are the major characteristics of primary memory:

- Primary memory is an internal memory.
- It is more expensive than secondary memory.
- It is faster than secondary memory.
- It can directly communicate with the CPU.
- It memory can be temporary or permanent.
- Its storage capacity is limited.
- It generally loads currently running applications.

4.4.2. Types of Primary/Main Memory

The basic two types of primary memories are: RAM and ROM.

a. Random Access Memory (RAM)

Random Access Memory (RAM) is the volatile memory or short-term memory of a computer system. It executes both reading and writing

Random Access Memory

operations. It can read and store data randomly from any physical location within it. RAM holds data and instructions during processing. Since it is volatile memory, data stored in RAM is erased when the power supply is turned off. Hence, to retain files permanently, they must be stored on secondary storage devices like a hard disk. RAM is classified as R/W (read-write) memory since it allows both reading and writing operations. Upon powering on the CPU, system files stored on the hard disk are loaded into primary memory RAM. There are two main types of RAM: Static Random Access Memory (SRAM) and Dynamic Random Access Memory (DRAM).

i. **SRAM:** Static Random Access Memory, retains data in a static state as long as power is supplied to the memory. This semiconductor-based memory stores data and instructions without the need for periodic refreshment, unlike DRAM. While SRAM is more costly than DRAM, it offers faster performance. Typically employed as cache memory, SRAM consumes less power compared to DRAM.

ii. **DRAM:** Dynamic Random Access Memory, is constructed using capacitors. Data stored in this type of RAM is prone to loss within a few milliseconds, even when the computer is powered on, necessitating periodic circuit refreshment. DRAM's design involves capacitors, where charge leakage occurs. While DRAM is less expensive and slower compared to SRAM, it finds common usage in PCs due to these characteristics.

Difference between SRAM and DRAM

SRAM	DRAM
a. It is made up of transistors.	a. It is made up of capacitors.
b. It is more expensive.	b. It is less expensive.
c. SRAM doesn't need periodic refreshment.	c. DRAM needs periodic refreshment.
d. Charges doesn't get leaked from SRAM.	d. Data charges gets leaked from DRAM.
e. SRAM are less dense.	e. DRAM are denser.

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f. It is faster than DRAM.	f. It is slower than SRAM.
g. Data is stored in the form of voltage.	g. Data is stored in the form of charge.

b. **Read-Only Memory (ROM)**

ROM exclusively retains information that can solely be accessed for reading purposes. Altering data stored in ROM presents a challenge. Serving as the non-volatile memory of a computer system, ROM ensures that data and instructions remain intact
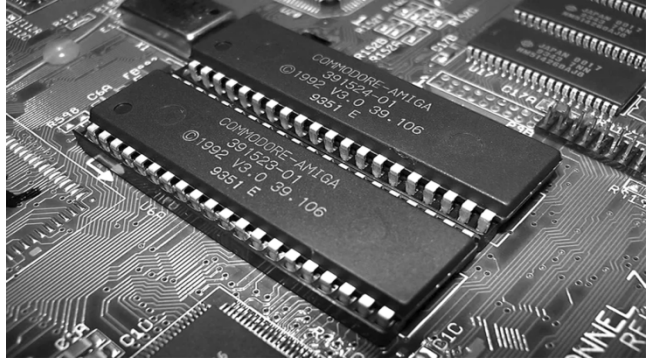
Read Only Memory

even when the power supply is disconnected. Unlike volatile memory types, ROM doesn't require a constant power supply to preserve stored data. The instructions within ROM are embedded during manufacturing by the respective manufacturer. Given its read-only nature, users cannot modify the contents of ROM. This type of memory commonly stores BIOS (Basic Input Output System) information essential for booting up the computer. The programs housed in ROM are known as firmware. Variants of ROM include PROM, EPROM, and EEPROM.

i. PROM: PROM, or Programmable Read-Only Memory, refers to a type of ROM with a unique characteristic: it can be programmed just once but read multiple times thereafter. Once data and instructions are stored in PROM, they become permanent and cannot be erased. Similar to other ROM types, PROM maintains its contents even when the power is off. Unlike ROM, which comes with pre-installed contents during manufacturing, PROM is initially blank upon manufacture. To write data onto PROM, a specialized device called a PROM programmer or PROM burner is employed. Once programmed, PROM cannot be altered or erased, making it suitable for storing permanent data in digital electronic devices.

ii. EPROM: Erasable Programmable Read-Only Memory (EPROM) is a form of ROM that offers the capability of being reprogrammed multiple times. However, reprogramming EPROM requires specialized techniques involving

UV (ultraviolet) light rays. The contents stored on EPROM can be erased and rewritten using these UV rays. It's important to note that frequent erasures of EPROM can lead to wear and tear, potentially affecting its lifespan.

iii. **EEPROM:** Electrically Erasable Programmable Read-Only Memory (EEPROM) is a variation of EPROM that offers the capability to erase and write data electronically using electrical signals within a millisecond. Unlike traditional EPROM, EEPROM does not require special techniques or laboratory conditions to delete or write content onto it. This flexibility allows for the efficient modification of data without the need for external tools or UV light exposure. Whether it's a single byte of data or the entire content of the device, EEPROM provides the convenience of electrically erasable and writable memory.

Difference between RAM and ROM:

Random Access Memory	Read Only Memory
a. It is the volatile memory of computer system.	a. It is the non-volatile memory of computer system
b. Currently using data and instructions are stored in RAM.	b. BIOS data and instructions are stored in ROM.
c. The content of ROM gets erased when the power supply is turned off.	c. The content of ROM doesn't gets erased when the power supply is turned off.
d. Programs and files in RAM are loaded when the computer starts booting.	d. Program in ROM are stored during the time of manufacturing.
e. RAM has high storage capacity.	e. ROM has less storage capacity.
f. RAM is expensive.	f. ROM is less expensive.

c. **Cache Memory**

The high speed memory between primary memory RAM and CPU is known as cache memory. The cache memory is used to store frequently accessed data and instruction during the time of processing by CPU. It is the high speed volatile memory available to the processor for fast processing. The storage size of cache memory is small. The CPU first search data in cache for processing if not found there then looks in RAM and loads to cache memory. The main importance of cache memory is to make the CPU execution faster.

d.   Virtual Memory

Virtual memory is the memory management concept and technique where secondary memory is used as the part of primary memory. Because your computer has a finite amount of RAM, it is possible to run out of memory when too many programs are running at one time. This is where virtual memory comes in. Virtual memory increases the available memory your computer has by enlarging the "address space," or places in memory where data can be stored. It does this by using hard disk space for additional memory allocation. However, since the hard drive is much slower than the RAM, data stored in virtual memory must be mapped back to real memory in order to be used.

e.   Buffer Memory

Buffer memory is the temporary storage area for data while transferring to another location. The buffer memory improves the overall performance of the system. The most common use of buffer is to act as a holding area, for enabling CPU to manipulate data before transferring to another location.

4.5. Secondary Memory

Primary memory, though essential, is characterized by its high cost, limited capacity, and volatile nature. When it comes to storing large volumes of data permanently at a more economical rate, secondary memory steps in to fulfill this need. Secondary memory, whether internal or external to the computer, serves as the permanent storage medium. It's also referred to as auxiliary or backup memory within the computer system. Unlike primary memory, secondary memory is non-volatile, meaning data and instructions remain intact even when the computer is powered off. With a higher storage capacity compared to primary memory, secondary storage devices offer a more cost-effective solution. While they may be slower, they are also less expensive than primary memory. Secondary storage devices go by various names such as auxiliary storage, backup storage, or permanent storage. Examples of secondary storage devices include magnetic and optical storage devices.

4.5.1. Characteristics of Secondary Memory

- It is cheaper than primary memory.
- It can store large volume of data than primary memory.
- It is also called backup memory.

- It is permanent memory.
- It is also often called as auxiliary memory.

4.5.2. Types of Secondary Memory

a. Magnetic Storage Devices

Magnetic storage devices store data using a magnetic layer on their surface. This layer can be magnetized in different directions to represent binary 1s and 0s. When the disk spins, a reader interprets the stored data. The surfaces of

Magnetic Tape

these devices are coated with materials like iron oxide, which can be magnetized to store data in binary form. Magnetic storage devices offer large data capacities at reasonable prices.

i. **Magnetic Tapes:** Magnetic tapes were the traditional types of storage devices where data were accessed in sequential order. These tapes were normally used for analog audio recordings. And early computer used these tapes to store the digital data.

ii. **Floppy Disk:** A floppy disk consists of a flexible disk coated with magnetic material, encased in a protective plastic covering. Once a prevalent form of portable storage, they could hold up to 1.44 MB of data. However, they are now obsolete due to their limited storage capacity and reduced portability. To access data on a floppy disk, a Floppy Disk Drive (FDD) is required for reading and writing. IBM pioneered the creation of the

Floppy Disk

first floppy disk. Floppy disks come in various sizes, with the disk's physical dimensions determined by its inch size.

iii. **Hard Disk:** The Hard Disk is the primary non-volatile secondary storage in personal computers. It surpasses other secondary storage devices in both storage capacity and speed. It holds all computer data in a magnetic format and is typically installed internally, directly connected to the motherboard's disk controller.

Comprising one or more platters coated with magnetic material, data is written onto both sides of these spinning platters by a magnetic head that moves rapidly over them. The Hard Disk plays a crucial role in storing the operating system, as well as the installation of essential programs and user files. Each platter is mounted on a central spindle, and its surface coated with magnetic material. While both surfaces of the disk can store data, only one side of the

Inside view of Hard disk

top and bottom disks is coated. Information is stored and retrieved from the rotating disk surfaces using magnetic read/write heads, each associated with an access arm.

These days, many computers opt for an SSD (Solid State Drive) as their main storage instead of an HDD. While HDDs are slower at reading and writing data, they provide more storage space for the money.

iv. **Flash Memory (Pen Drive):** Flash memory is a form of non-volatile memory known for its ability to retain data even when power is turned off. This feature makes it ideal for storage and transferring data between personal computers and various digital devices. Its electronic reprogramming and erasing capability add to its versatility. Flash memory is commonly integrated into

Pen Drive

USB flash drives, MP3 players, digital cameras, and solid-state drives (SSDs). Data stored in flash memory is erased in blocks, necessitating the removal of entire blocks before new data can be written. Despite being more expensive than traditional hard drives and RAM, flash memory offers advantages such as durability, portability, and faster access times. These qualities have contributed to its widespread adoption in modern technology.

b. **Optical Storage**

Optical storage devices utilize laser light beams to both read and write data onto

their surfaces. However, their storage capacity tends to be lower when compared to magnetic devices.

i. **CD-ROM:** Compact Disk Read Only Memory (CD-ROM) is a frequently used secondary storage device that operates on laser beam technology for data reading and writing. Once data and instructions are stored on a CD-ROM, they become permanent and cannot be altered or erased. To access the data on the disk, a CD or DVD drive is required. Compared to floppy disks, CD-ROMs offer a larger storage capacity.

Figure: Compact Disk
Compact Disk

ii. **CD-RW:** A Compact Disk Rewritable (CD-RW) is an optical storage device that allows data to be stored by burning a CD using specialized software called a CD burner. Unlike a CD-R (CD-Recordable), a CD-RW can be written to multiple times. While the data burned on a CD-RW cannot be altered, it can be erased. Therefore, to make changes or add new data, the entire CD-RW must be completely erased each time.

iii. DVD ROM: DVD-ROM, short for Digital Versatile Disk Read Only Memory, is an optical storage device renowned for its expansive storage capacity. Data and information stored on a DVD-ROM cannot be altered or erased, hence the term "read-only." It is frequently employed for storing large software applications. Similar to a CD-ROM (Compact Disk Read Only Memory), but with a greater capacity, a DVD-ROM can store approximately 4.38 GB of data, whereas a CD-ROM typically holds around 650 MB.

iv. Blu-ray Disk: Blu-ray Discs, commonly referred to as BD discs, are optical storage devices that employ a blue laser beam for reading and writing data, in contrast to CDs and DVDs, which use a red laser beam. This difference allows BD discs to store more data in less space, resulting in a higher storage capacity compared to CDs. Blu-ray discs are typically utilized for storing large software packages, recording, rewriting, and playing HD videos. They can hold up to 25 GB of data.

Blu-ray Disk

Fundamentals of Computer and Application/Grade 9

Difference between primary and secondary memories

Primary Memory	Secondary Memory
a. Primary Memory is considered as main memory of computer system.	a. Secondary memory is also known as auxiliary or backup memory.
b. It can directly communicate with CPU.	b. Secondary memory indirectly communicate with CPU.
c. The storage capacity of primary memory is less than secondary memory.	c. The storage capacity of secondary memory is high than primary memory.
d. Primary memory is faster than secondary memory.	d. Secondary memory is slower than primary memory.
e. It is more expensive.	e. It is less expensive
f. Information stored in primary memory cannot be moved from one place to another.	f. Information stored in secondary memory can be transferred from one computer to another.
g. Data and instructions to be currently executed are stored in primary memory.	g. Data and information to be stored permanently are kept in secondary memory.
h. Primary memory can be both volatile and non-volatile.	h. Secondary memory is non-volatile in nature.
i. Primary Memory has faster access time.	i. This memory has low access time.
j. Examples: RAM, ROM, Cache	j. Examples: Pen drive, CD, Hard Disk.

"DEAM 4" and "DEAM 5" are novel memory models based on the concept of dynamic and distributed processing in the brain. DEAM 4, or Dynamic Episodic Associative Memory 4, highlights the fluidity of memory encoding, the relevance of associative networks in memory storage, the reconstructive process of retrieval, and the significance of brain plasticity in memory adaption. In contrast, DEAM 5, or Distributed Episodic Associative Memory 5, emphasizes distributed processing across multiple brain regions, parallel memory systems specialized for different types of information, the importance of contextual binding for effective recall, adaptive mechanisms such as memory reconsolidation, and the influence of embodied cognition, which emphasizes the role of sensory and physical experiences in memory processes.

Exercise

Choose the correct answer from the given alternatives.

1. Which of the following is non-volatile memory?

   a. ROM   b. RAM   c. Cache   iv. Register

2. The fastest memory of computer system is ….

   a. Hard Disk   b. RAM   c. Cache   iv. Register

3. The key difference between RAM and ROM is………..

   a. RAM is internal and ROM is external memory

   b. RAM is non-volatile and ROM is volatile.

   c. RAM is volatile and ROM is non-volatile.

   iv. RAM is external and ROM is internal.

4. The another name of secondary memory is ……..

   a.Temporary   b. Internal   c. Auxiliary   d. All of the above

5. Which of the following is high speed memory between RAM and CPU?

   a. Register   b. Cache   c. Hard Disk   d. All of the above

6. Which of the following is Optical Storage Device?

   a. CD   b. DVD   c. BD I   d. All of the above.

7. ……….is the sequential storage device.

   a. Magnetic Tape   b. Hard Disk   c. RAM   d. ROM

8. The ………RAM needs periodic refreshment.

   a. SRAM   b. DRAM

   c. Both i and ii   d. None of the above

9. ……uses electric charges for erasing content.

   a. EPROM   b. EEPROM

   c. PROM   d. None of the above

10. ……….is secondary memory.

    a. Hard Disk   b. Pen drive   c. CD   d. All of the above

Write short answers to the following questions.

1. Define RAM.
2. List different types of ROM.
3. What is sequential storage device?
4. Define computer memory.
5. Give some examples of Primary Memory.
6. Define ROM? List out its types.
7. What is Cache memory?
8. Define SRAM and DRAM.
9. What is EEPROM?
10. What is magnetic storage device?
11. What is optical storage?
12. Define Blu-ray Disk.
13. What is primary memory?
14. Define virtual memory.

Write long answers to the following questions.

1. Define computer memory. Why it is necessary in computer system?
2. What is primary memory? Lists its features.
3. Define secondary memory? List its features.
4. What is cache memory? Discuss its importance.
5. List different types of memory.
6. Describes the uses of cache memory in computer. List its labels.
7. List advantages and disadvantages of cache memory.
8. Differentiate between SRAM and DRAM.
9. What is RAM? List its characteristics.
10. What is ROM? Discuss its features.
11. Write short notes on: PROM, EPROM, EEPROM.
12. List the characteristics of primary memory.
13. List the characteristics of secondary memory.
14. Differentiate between primary and secondary memory.

Fundamentals of Computer and Application/Grade 9

15. Why is a hard disk called as a permanent memory?

16. Why is RAM known as a volatile memory?

17. Write short notes on:

    a.   Hard Disk

    b.   SSD

    c.   Optical Storage

    d.   Blu-ray disk

    e.   Flash Memory

Project works

1. Describe computer memory and its main types by using power point presentation and demonstrate.

2. Prepare a presentation about "HDD and SSD" and demonstrate.

3. Prepare a presentation about different storage hardware found in computer lab and demonstrate in classroom.

4. Draw a chart paper about different types of computer memory with your name and paste it into your classroom.

5. Visit the IT solution office such as the computer maintenance center and sales, and collect the latest available memory devices.

Internet and Its Application

5.1. Introductin to Internet and its Advantage

The Internet, often referred to as the International Network or Interconnected Network, represents the largest assembly of interconnected computers worldwide. It functions as a network of networks, uniting millions of private, public, government, and other networks through wired and wireless technologies, operating on a common and standardized protocol known as TCP/IP (Transmission Control Protocol/Internet Protocol). Each connected node on the internet is identified by a unique address called an IP address. This interconnection of networks enables the provision of diverse services such as chat, VOIP calls, email, file sharing, and more. Nowadays, a vast majority of people worldwide utilize the internet for various daily tasks. It facilitates the exchange of information in multiple formats, including text, images, data, programs, audio, and video, thus offering a wide array of services in our everyday lives.

Differences between Intranet, Internet and Extranet

Internet	Intranet	Extranet
The internet is a publicly accessible world wide networks of computers.	The intranet is a private computer networks of an organization that is accessible only by the people within the organization.	The extranet is a private network of computers of an organization which allows employees and some other people outside of the company to access the network.
This network is accessible to anyone.	This network is accessible to employees of the organization.	This network is accessible to employees of the organization and some other people.

Advantages of Internet

- It is helpful for information Sharing
- It inhance faster Communication.
- It faster abundant Information
- It enhance better educational opportunities.

- It provides varieties of ways for entertainment.
- It healps for social connectivity

Disadvantages of Internet
- Internet Addiction
- Increase in cyber crime
- Chance of spreading computer viruses
- Social Alienation
- Risk of spam
- Fake news
- Health Issues

5.2. Requirements for Internet Connection
- A computer system
- Network Interface Card (NIC)
- Router/modem
- Internet Service Provider (ISP)

5.3. Application of Internet

a. WWW (World Wide Web)

The World Wide Web (WWW) stands as the internet's most popular service, boasting the largest repository of information globally. This vast collection comprises HTML (Hypertext Markup Language) formatted documents stored on web servers. These documents encompass a variety of content types, including text, graphics, audio, video, and hyperlinks, facilitating seamless navigation between them for users. Tim Berners-Lee, a British scientist, conceived the World Wide Web in 1989 during his tenure at CERN.

b. Email

Email, short for electronic mail, constitutes a fundamental service of the internet, facilitating the electronic delivery of messages. It serves as a platform for efficient and inexpensive real-time communication, allowing users to send not only text but also attached files and documents. Sending an email requires the email addresses of both the sender and recipient. In 1971, Ray Tomlinson, a

computer engineer at the Massachusetts Institute of Technology, sent the first-ever email, marking a significant milestone in digital communication.

An email address, often referred to as an email ID, serves as a unique identifier for an electronic mailbox on a computer network. Each individual possesses a distinct email address, comprised of two parts separated by the "@" symbol: the username and the hostname.

For example: *abc.example@gmail.com*. Here abc.example is username and gmail.com is host name.

Advantages of Email

> » It is the fastest medium of communication.
> » It is the cheapest means of communication.
> » Email is reliable and secret.
> » It helps to keep mail as a backup also.
> » We can send the same mail to multiple email addresses.
> » It supports various kinds of attachments.

c. Usenet/Newsgroup

Usenet functions as a discussion platform where individuals engage in sharing their perspectives and ideas on topics of mutual interest. Articles posted within specific newsgroups are accessible to all members of the group. Participants with shared interests join these groups to contribute comments to existing posts and create their own content. This fosters seamless information sharing within a community. The inception of Usenet can be traced back to the innovative approach introduced by two Duke University graduate students, Tom Truscott and Jim Ellis. They pioneered a method for exchanging messages and files between computers using the UNIX-to-UNIX copy protocol (UUCP), marking the genesis of Usenet.

d. Telnet (Telecommunication Network)

Telnet stands out as a crucial component of the internet, serving as the protocol enabling users to remotely log in to computers. To access remote computers, various software applications such as **AnyDesk** and **TeamViewer** are utilized. The initial iteration of Telnet was developed in the 1960s for the Advanced

Research Projects Agency Network (ARPANET).

e. Remote Control

Remote control encompasses the capability to oversee and manage a device or system from a distant location via a network connection. This functionality proves vital for various tasks like remote administration, monitoring, and troubleshooting of networked devices. It empowers administrators or users to access and handle devices such as servers, routers, switches, and computers from a centralized location, regardless of physical proximity. Typically, this capability is facilitated through specialized software or protocols like Remote Desktop Protocol (RDP), Virtual Network Computing (VNC), Secure Shell (SSH), or proprietary solutions crafted by device manufacturers. Remote control within networking heightens efficiency and flexibility by enabling administrators to conduct tasks remotely, thereby lessening the necessity for physical access to devices and reducing downtime for maintenance and support endeavors.

f. Internet Relay Chat (IRC)

Instant messaging or IRC entails internet-based communication wherein users swiftly exchange text messages. This form of communication facilitates real-time textual interaction among network-connected devices. In 1996, the Israeli company Mirabilis introduced ICQ, a text-based messenger famously abbreviated as 'I Seek You'.

g. E-commerce (Electronic Commerce)

E-commerce is a big hit on the internet. It's all about buying and selling stuff using the internet. Lots of websites let you shop online and get things delivered right to your home. This is all possible because of the internet. In Nepal, websites like www.daraz.com.np and www.hamrobazaar.com are quite popular for online shopping. The first-ever e-commerce company, Boston Computer Exchange, started in 1982.

h. Search Engine

A search engine is a tool that allows users to efficiently locate information on the internet. Functioning as intricate algorithms, search engines continuously scan and categorize web pages, compiling an extensive database of searchable material. Users enter keywords or phrases into the search engine's interface, triggering it

to generate a list of pertinent web pages from its index. Sophisticated ranking algorithms are employed by search engines to prioritize search results, taking into account factors such as relevance, content quality, and website credibility. Equipped with features like autocomplete, filtering options, and specialized search tools, search engines streamline the process of finding desired information amidst the vast expanse of the internet, ultimately enhancing accessibility and information retrieval for users.

A search engine is a software or website which helps to search information based on keywords. It searches the content via WWW. The searched content is displayed in the form of a website, image, video or other media. Google, Ask, Bing are some of the popular search engines. Archie is considered to be the first search engine that is used to search files over FTP

i.   **E-Governance**

E-government, also termed electronic governance, involves the utilization of digital technology and information communication technologies (ICTs) by governments to deliver public services, interact with citizens, and enhance governance procedures. The objective of e-government initiatives is to improve the efficiency, transparency, and accessibility of public services such as healthcare, education, taxation, and administrative processes. Through the utilization of online platforms, mobile apps, and electronic databases, e-government enables convenient access to government services and information, simplifies bureaucratic procedures, and encourages citizen engagement in decision-making. Furthermore, e-government endeavors lead to cost reductions, decreased paperwork, and heightened accountability in government operations, ultimately fostering improved governance and responsiveness to citizen needs in the digital era.

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following is service of the Internet?

    a. Email   ii. Newsgroup   c. Telnet   iv. All of above

2. ………….is a valid email address.

    a. abcd@gmail.com   b. Abcdgmail.com

    c. abcdgmail@.com   d. @abcdgmailcom.

3. The discussion platform where individuals engage in sharing their thoughts is ….

    a. Usenet   b. Telecommunication

    c. Newspaper   d. web browser

4. Process of buying and selling goods through internet is ……..

    a. Online business   b. Daraz

    c. Ecommerce   d. E-governance

5. The program which helps users to search information over WWW is ……..

    a. Search engine   b. Chrome   c. Browser   d. Firefox

6. Which of the following is a search engine?

    a. Google   b. Yahoo   c. Bing   d. All of the above

7. Delivery of governmental services using ICT tools is known as …………

    a. E-governance   b. Ecommerce

    c. Online form   d. None of the above

Write very short answers to the following questions.

1. Define the internet.
2. What does TCP/IP stand for?
3. What is the acronym of VOIP?
4. List two advantages of the internet.
5. List any two requirements of the Internet.

6. What are two popular search engines?

7. Define Usenet.

Write short answers to the following questions.

1. What is the internet? List its advantages and disadvantages.

2. List the major requirements of an internet connection.

3. What is email? List the advantages of email.

4. What is e-commerce? List the advantages and disadvantages of e-commerce.

5. What is the importance of IRC?

6. Define e-Governance with example.

Write long answers to the following questions.

1. What are the different services available over the Internet? Describe their uses.

2. What is WWW? What are the advantages of WWW?

Project works

1. Collect name of ISP provider in your locality.

2. Make a presentation on "Internet Applications".

3. Prepare a Power Point Presentation file on a topic "Current trends of Internet and its use in Nepal"

Multimedia

6.1. Introduction to Multimedia

The term "multimedia" originates from the combination of two words multi and media where "multi" means many or more than one, and "media" referring to channels, ways, methods, or mediums used to share ideas, feelings, or information. It encompasses the fusion of two or more types of media, such as video, sound, animation, text, and pictures. Multimedia proves highly beneficial and effective in presenting information in an understandable, engaging, and interactive manner. It empowers users to influence the material's presentation through selection and manipulation. This interactive aspect is integral to multimedia presentations, which may incorporate images, audio, video clips, or text to demonstrate concepts in various settings like training sessions, seminars, or workshops. Utilizing large screens or projectors, multimedia facilitates information display to large audiences, whether physically present or engaged in online settings. Today, online training and learning systems extensively leverage multimedia tools. Despite their advantages, multimedia files typically demand substantial storage space compared to other formats. Common storage mediums include CDs and DVDs, chosen for their compatibility, cost-effectiveness, and storage capacity. With the widespread availability of online platforms and resources, users benefit from the high-speed internet and advanced technologies of computers and electronic devices, ensuring reliable access to multimedia content.

In other words we can say that multimedia is a computerized method of presenting information combining textual data, audio, visuals (video), graphics and animations.

Use of Multimedia in Recent World

- Information Sharing
- Engagement
- Education and Training
- Entertainment

- Advertising and Marketing
- Communication

6.2. Component of Multimedia

Multimedia components serve as the fundamental building blocks of any multimedia project. The proficient and strategic utilization and management of these components are crucial indicators of the presentation's effectiveness and appeal. Ultimately, the primary goal of multimedia is to convey information efficiently and compellingly to the intended audience.

a. **Text:** Text is the basic component of multimedia. It serves as a vital tool for expressing information effectively. Text has been used in almost everywhere. In most of the multimedia systems text is embedded with other medias for presenting information. The text in multimedia can be animated and designed using various text formatting options. It is emphasized by different text style, fonts and color. websites, powerpoint presentation, reports are some examples of text information.

b. **Audio:** In multimedia, we often need to use speech, music, and sound effects. These are known as the audio or sound part of multimedia. Speech is especially great for teaching purposes. There are two types of audio: analog and digital. Analog audio refers to the original sound signal, while digital audio is how computers store sound. So, in multimedia applications, we typically use digital audio.

c. **Image:** An image can be a graphic, chart, or picture. It's a really powerful and eye-catching part of multimedia that helps share information with the audience. They say a picture is worth a thousand words because images can convey a lot of information in a simple way. In any presentation or media, graphics are essential because they grab people's attention and make information easy to understand. When you combine text with graphics, it helps people grasp the subject clearly. Information presented with graphics also tends to stick in people's minds longer than just text. It's usually a good idea to include at least one picture related to the content on a webpage or document. Most web applications and pages use graphics to make things interactive and engaging. Things like forms, buttons, menu bars, icons, and scroll bars all show how important graphics are in any

application. Multimedia files support various image formats like .jpeg, .jpg, .tiff, .png, .gif, and more.

d. **Video:** Video is one of the best ways to show information quickly. It involves recording and displaying sequences of pictures in a short amount of time to create motion, basically, moving pictures. Adding relevant and realistic videos to a multimedia presentation makes it more effective by entertaining and impressing the audience. Videos help clarify concepts and can serve as evidence in research, projects, or work to improve performance. They also help people remember information for longer.

Nowadays, videos are essential sources of information and are integral to multimedia. Examples include television, documentaries, movies, YouTube, and other online videos. There are various video formats like MP4, MPEG, AVI, Flash, WMV, and QuickTime.

You can capture real-life events as memories using video recording devices like digital cameras, smartphones, tablets, or digital video recorders. However, videos require a lot of storage space for recording, storing, delivering, and displaying. Digital video is increasingly popular, especially on the web, due to the reliability of advanced digital devices, high-speed internet access, and web applications like social media platforms such as Facebook, YouTube, Instagram, and TikTok.

e. **Animation:** Animation is the art of creating moving images through a sequence of still drawings, models or computer-generated graphics.

Animation is when you make things look like they're moving by showing a series of pictures. Computer animation is a technology that makes these moving images appear on a screen. It's used to show things, objects, characters, or ideas that might not be possible in real life.

Animation is like bringing objects to life in computer graphics. It can make even the most lifeless things seem lively and full of emotions. There are two main types of computer animation: computer-assisted animation and computer-generated animation. These animations can be shown in movies, videos, or games.

Computer animation is used in many different fields like movies, education, online shopping, art, and training. In entertainment, it's a big deal because a lot of backgrounds and scenes are created with special effects and animation.

You can think of computer animation as the art of making non-living things seem alive and full of energy and emotion. It lets us do things that might seem impossible otherwise. The trick behind computer animation is showing images really fast so that our brains see them as a smooth, continuous movement.

6.3. Application of Multimedia

Business

Multimedia has various uses in business, making it an essential component. One crucial aspect in business is advertising products to inform customers about them. Multimedia, combined with communication technology, has facilitated global information dissemination. Many designers utilize multimedia for product promotion through various mediums like print, audio, or video. Integrating advertisements into social media and popular videos is an effective way to reach a large audience in today's world. Moreover, with team members working remotely from different locations, the workplace has become global, allowing individuals to collaborate with various companies from anywhere.

Multimedia in Business

Marketing and Advertising

Multimedia advertising involves using animation and graphic design to promote and sell products or services. Multimedia technology is employed to create attractive and engaging advertisements. This technology is particularly effective for launching new products, garnering attention, and boosting marketing efforts at a reasonable cost.

Multimedia-based advertisements often include flying banners, video transitions, animations, and sound effects to captivate consumers and drive product sales. Through strategies like search engine optimization, keyword research, and strategic

linking, companies can broaden their audience reach and increase sales. By attracting more website visitors, the likelihood of converting them into customers also rises.

Additionally, there are various other forms of multimedia advertising available, including DVDs, CD-ROMs, videos, and online advertising, which serve to raise awareness of the company and its products.

Entertainment

Entertainment stands as one of the most thrilling applications of multimedia. The entertainment industry heavily relies on this technology, especially in crafting lifelike gaming experiences. Numerous multimedia games are now accessible on computers, with online gaming featuring multiple players gaining immense popularity. Integrated audio and video effects contribute significantly to enhancing the entertainment value of various game genres.

Special technologies like virtual reality have taken gaming experiences to new heights, offering immersive simulations akin to real-life scenarios. A prime example of this is the flight simulator, which replicates real-world flying experiences. Children, in particular, find these experiences exhilarating, enabling them to engage in activities such as driving different types of cars, piloting aircraft, playing musical instruments, or even enjoying a round of golf.

Over the past decade, social media platforms such as Facebook, YouTube, Tiktok, Twitter and Instagram have had a profound influence on the entertainment industry. Social media entertainment has expanded rapidly. Digital platforms have created a new market and influences to content creators, their fans, and subscribers.

Education

Multimedia technology provides educators with innovative learning methods that can be implemented in both classroom and home settings. Equipping teachers with multimedia learning resources enables them to facilitate constructive concept development and focus on individualized instruction. Moreover, extending the use of multimedia resources to home environments presents an opportunity to enhance distance learning experiences.

Numerous educational computer games are now accessible, offering interactive learning experiences. For instance, consider an educational game that introduces various rhymes to children. In addition to playing rhymes, children can engage in

activities like painting pictures and adjusting the size of objects, fostering creativity and cognitive development. Furthermore, there are various multimedia packages available on the market that offer comprehensive information and interactive features designed specifically for children.

Multimedia in Education

Bank

In recent times, multimedia has found increasing applications in banks, which serve as another public space where it is utilized. People visit banks for various purposes, such as opening savings or current accounts, depositing funds, withdrawing money, learning about different financial schemes, and obtaining loans. Banks have a wealth of information to share with their customers, and multimedia serves as an effective tool for this purpose.

For instance, banks utilize multimedia to display information about their various schemes on PC monitors placed in customer waiting areas. Additionally, the popularity of online banking, internet banking, and mobile banking has soared, all of which extensively incorporate multimedia elements. As a result, multimedia plays a crucial role in enhancing customer service at banks and educating customers about the attractive financial schemes they offer.

Hospital

In hospitals, multimedia serves a critical role in real-time patient monitoring, especially for those in critical condition or involved in accidents. Patient conditions are continuously displayed on computer screens, enabling doctors and nurses to be alerted to any changes observed. Moreover, multimedia facilitates remote consultations, allowing surgeons or experts to watch ongoing surgeries on their PC

monitors and provide online advice as needed.

Additionally, multimedia aids in diagnosing illnesses through CD-ROMs, cassettes, or DVDs containing multimedia-based information about various diseases and their treatments. Many hospitals also utilize multimedia presentations to train their junior medical and nursing staff effectively. Furthermore, multimedia displays are extensively utilized during critical surgeries to enhance communication and efficiency in the operating room.

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following is not the element of multimedia?

    a. Text   b. Audio   c. Animation   d. All of the above

2. The recorded sound or voice is also known as…….

    a. Video   b. Animation   c. Sound   d. Graphics

3. The computer generated images falls under……

    a. Graphics   b. Video   c. Imagination   d. All of the above

4. The consecutive display of real images is……..

    a. Video   b. Animation

    c. Image   d. None of the above

5. The illusion created by consecutive display of frames…….

    a. Video   b. Graphics   c. Design   d. Animation

6. Which of the following is multimedia software?

    a. VLC media player   b. Window Media Player

    c. PowerPoint   d. All of the above

Write short answers to the following questions.

1. Define multimedia.
2. Write two applications of multimedia in education.
3. How can we use multimedia in entertainment?
4. List any three applications of multimedia in bank.
5. List any three applications of multimedia in Health.

Write long answers to the following questions.

1. What is multimedia? List its necessity in recent world.
2. Explain different component of multimedia.
3. What are the different applications of multimedia?

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4.   Explain the different application of multimedia in entertainment and education.

5.   How can we use multimedia in education?

6.   What is the role of multimedia in education?

7.   What is the role of multimedia in entertainment?

8.   How are filmmakers helped by multimedia technology?

9.   Do you agree that multimedia enhances the learning capacity of students? How?

Project works

1.   Make a presentation on "Multimedia Applications".

2.   Make a presentation on "Elements of multimedia".

3.   Prepare a multimedia presentation on any contemporary topic.

Emerging Technology

7.1. Introduction to Emerging Technology

The area of Information and Communication Technology (ICT) is advancing and changing rapidly and continuously. The software and tools that we are using today are popular and modern today becomes outdated tomorrow. This rapid pace of technological evolution poses challenges for individuals in adapting to new tools and methodologies. Remaining updated and adept at utilizing newly innovated tools has become essential.

Recent advancements in technology have significantly transformed various aspects of daily life. Many manual tasks have been replaced by digital tools, such as online shopping replacing traditional retail experiences. Moreover, communication methods and data exchange have evolved with the introduction of new technological trends.

The emergence of these new ICT trends has had far-reaching effects on business structures, job opportunities, communication processes, and public services. They have enhanced the functionality and presentation across various fields including medicine, entertainment, business, education, marketing, and law enforcement. These innovations have not only impacted internal processes but have also transformed interactions with customers and users. For example, the tools used by patients in hospitals today are vastly different from those used previously, reflecting the ongoing changes in our daily lives.

Given the frequency of new trends emerging in the IT sector, professionals must stay abreast of these developments. Regardless of one's profession, familiarity with new and recent technologies can enhance professional standing and facilitate understanding of potential upgrades.

7.2. Concept of AI

Artificial Intelligence (AI) is a branch of computer science focused on creating machines capable of simulating human intelligence, enabling them to think and act like humans. AI systems typically exhibit behaviors associated with human

intelligence, including thinking, learning, reasoning, problem-solving, planning, natural language processing, motion, and manipulation.

Traditionally, computers were primarily used for data manipulation, storage, and retrieval. However, the field of computer science and technology has expanded its scope to include AI, which enables machines to process various inputs and execute tasks similar to humans, drawing from past experiences. Common examples of AI applications include chess-playing programs, self-driving cars, natural language translation tools, face detection algorithms, and question-answering systems.

Through AI, computers can be programmed to perform specific tasks by analyzing large datasets and identifying patterns within them. The potential applications of AI span across numerous sectors, leading to widespread interest and appreciation for the technology's capabilities and the vast array of techniques and technologies developed alongside it.

Features of AI

a. AI systems can learn from data, experience and feedback.

b. AI systems can solve complex problems by reasoning and algorithms.

c. AI system can perceive and interpret sensory inputs such as images, sounds, and texts.

d. AI system can automatically processes task and reduce human labor.

e. AI systems can adapt new situations and environment by experience.

f. AI systems can process multiple processes parallel.

g. AI system can use logic and algorithms to analyze information, make decisions and solve problems.

Application of AI

a. **Gaming**

Artificial Intelligence (AI) plays a pivotal role in strategic games like chess, poker, tic-tac-toe, and others, enabling machines to analyze vast numbers of potential positions using heuristic knowledge.

b. **Natural Language Processing**

Computer can easily process the language spoken by human. They can interpret and respond to the language spoken by human.

c. **Expert Systems**

Expert systems are applications of artificial intelligence designed to emulate the decision-making ability of a human expert in a specific domain.

d. **Vision Systems**

These systems have the ability to process, interpret, and make sense of visual data on computers. For instance, a reconnaissance aircraft captures images that are analyzed to extract spatial data or map terrain. Clinical expert systems assist doctors in diagnosing patients. Law enforcement utilizes computer software capable of identifying criminals by matching faces to portraits created by forensic artists.

e. **Handwriting Recognition**

The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.

A branch of artificial intelligence devoted to the creation of algorithms that enable computers to learn from and make data-driven judgments. Rather than being explicitly programmed to do a task, Machine Learning algorithms employ statistical techniques to enhance their performance over time.

Types of Machine Learning

a. **Supervised Learning:** The algorithm learns from labeled data and makes predictions or decisions based on that knowledge. Examples include classification and regression tasks.

b. **Unsupervised Learning:** The algorithm finds patterns and relationships in unlabeled data. Clustering and association are often used strategies.

c. **Semi-supervised Learning:** Uses both labeled and unlabeled data to improve learning accuracy.

d. **Reinforcement Learning:** The algorithm learns through interaction with the environment and getting feedback in the form of rewards or punishments. This strategy is common in robotics and gaming.

Deep learning is a subfield of machine learning that uses neural networks with numerous layers to model and comprehend complicated patterns and representations in huge datasets. Deep learning algorithms, also known as deep neural networks, are inspired by the structure of the human brain. They automatically extract features

from raw data and improve performance over time via training procedures like back propagation and gradient descent. This method has transformed fields such as image and speech recognition, natural language processing, and autonomous systems by allowing machines to reach high levels of accuracy and capability in activities that previously needed human intellect.

7.3. Concept of Cloud Computing and Distributed Computing

Cloud computing is a widely used distributed technology that involves delivering various services over the internet. These services encompass tools and applications such as data storage, servers, databases, networking, and software. Companies like Amazon Web Service (AWS), Microsoft Azure, Google Cloud Platform, IBM Cloud Services, Adobe Creative Cloud, Kamatera, VMware, Oracle Cloud, and Rack spaces provide such services.

In today's world, there is a plethora of cloud-based applications available, and online users are increasingly engaging with services such as messaging, mobile apps, and online gaming. Platforms like Google Drive, OneDrive, Dropbox, iCloud, and iDrive offer cloud-based storage, allowing users to store files, documents, photos, videos, and more, accessible from anywhere and at any time. This has become a preferred alternative to carrying physical storage devices like pen drives, optical disks, and hard drives.

Cloud computing facilitates enhanced collaboration and productivity while significantly reducing costs. It also ensures better data protection, improved availability, and broader access to cutting-edge technologies.

Some of the features of Cloud Computing are

i.   On-demand Self-Service

Cloud computing provides its services when a user need it. So the services of computing are provided on the demand of user.

ii.   Broad Network Access

The services can be accessed through web browsers using any internet-connected device, without requiring any specific infrastructure for access.

iv.   Resource Pooling

Resource pooling in cloud computing refers to the practice of aggregating and

sharing computing resources among multiple users or applications to efficiently meet varying demands.

v.   Rapid Elasticity

Rapid elasticity is a key characteristic of cloud computing that refers to the ability to quickly and seamlessly scale computing resources up or down based on demand.

vi.   Security

The security mechanism in cloud storage surpasses that of traditional systems. Data is safeguarded through enhanced centralization and dedicated security resources, ensuring robust protection in cloud storage.

Model of Cloud Computing

There are three main service models of cloud computing:

i.   Infrastructure as a Service (IaaS): In Infrastructure-as-a-Service (IaaS), users are granted access to computing resources like servers, storage, and networking by the service provider. Users can utilize their own platforms and applications within the infrastructure provided by the service provider.

ii.   Platform as a Service (PaaS): In Platform as a Service (PaaS), the service provider offers users a cloud environment for developing, managing, and delivering applications. Alongside storage and other computing resources, users have access to a range of prebuilt tools to develop, customize, and test their applications.

iii.   Software as a Service (SaaS): In Software as a Service (SaaS), the service provider offers users access to cloud-based software. Users can store, analyze data, and collaborate on projects through the application without the need to install applications on their local devices.

Application of Cloud Computing

- It is commonly used in business for customer relationship management, enterprise resource planning and human resource management.
- Cloud storage provide very convenient and scalable solutions for storing and backing up data through Google Drive, Dropbox…etc.
- It provide developers with scalable in fracture and services to develop, test and deploy applications without the need for on premises hardware.
- Cloud computing enables organizations to analyze large volumes of data using tools

and services available on cloud.

- Cloud computing helps to provide flexible and scalable platform to efficiently collect, store and analyze data generated by IoT devices.

- Cloud computing supports e-commerce websites by providing scalable and reliable infrastructure.

Fog computing, also known as fog networking or fogging, is a cloud computing extension that relocates computational resources and services to the network's edge, where data is generated. This method decreases latency and bandwidth consumption by processing data locally or at adjacent nodes rather than depending only on centralized data centers. Fog computing enables real-time analytics and decision-making, which is critical for applications such as self-driving cars, smart grids, and IoT devices. In complex and distributed systems, fog computing improves efficiency, security, and scalability by bringing data processing closer to the source.

Edge computing is a paradigm that moves data processing and storage closer to the data source, such as sensors, IoT devices, or local edge servers, rather than depending on centralized cloud data centers. This strategy reduces latency, bandwidth utilization, and reaction times by allowing for real-time data processing and analysis at the network edge. Edge computing is critical for applications that require quick response, such as self-driving cars, industrial automation, and smart cities. Edge computing improves performance, reliability, and security by localizing data handling, allowing for faster and more effective decision-making in complex, dispersed situations.

7.4. Concept of IOT

People are increasingly participating in the digital world, whether consciously or unconsciously. Various types of electronic devices, software, apps, websites, and browsers are essential components for engaging in this digital realm. Establishing connections with these elements requires access to the internet.

The concept of the Internet of Things (IoT) encompasses the electronic devices in our surroundings that are interconnected via the internet, enabling them to collect and share data and information. IoT involves the integration of physical objects embedded with sensors, software, and other technologies, facilitating the exchange of data with other devices and systems over the internet. For instance, while a television typically comes with its own remote controller, it can also be controlled via a smartphone by

downloading the requisite apps. Similarly, smartphones can control various other electronic devices such as electric bulbs, MP3 players, and kitchen appliances. Smart thermostats can regulate streetlights to turn on or off automatically without human intervention. Sensors like GPS and motion sensors continuously transmit user information over the internet. Weather forecasting apps provide real-time weather reports worldwide through the internet. Consequently, people are becoming more efficient and responsive by leveraging the Internet of Things.

Fundamentally, the Internet of Things revolves around the interaction of people, processes, and things.

Feature of Internet of Things

Some characteristics of Internet of things as follows:

a.   Connectivity

b.   Analyzing

c.   Integrating

d.   Sensing

e.   Active Engagement

f.   Endpoint Management

7.5.   Concept of Big Data

Big Data encompasses vast volumes of data that grow exponentially over time. It refers to intricate and extensive datasets requiring processing and analysis to extract valuable insights beneficial to businesses and organizations. This data is of such immense size and complexity that traditional data management tools struggle to store and process it efficiently. Big data represents a scale beyond conventional parameters.

Data collection for big data spans various sources, including publicly shared comments on social networks and websites, voluntarily provided information from personal electronics and apps, responses to questionnaires, product purchases, and electronic check-ins. Smart devices equipped with sensors and other inputs facilitate data gathering across diverse situations and contexts. For instance, statistics reveal that Facebook's databases ingest over 500 terabytes of new data daily, primarily from photo and video uploads, message exchanges, and comments. Similarly, a single jet

engine can produce over 10 terabytes of data in just 30 minutes of flight time. With thousands of flights occurring daily, data generation can reach into the petabytes.

Types of Big Data

a.   Structured

Structured data denotes information organized in a predetermined format, facilitating processing, storage, and retrieval. This type of data is meticulously arranged, enabling straightforward access through basic search engine algorithms. For example, within a company database, the employee table is structured with organized details such as employee information, job positions, and salaries.

b.   Unstructured

Unstructured data refers to the data that lacks any specific form or structure whatsoever. This makes it very difficult and time-consuming to process and analyze unstructured data. Email is an example of unstructured data.

c.   Semi-structured

Semi structured is the third type of big data. Semi-structured data pertains to the data containing both the formats mentioned above, that is, structured and unstructured data.

Features of Big Data

*   It can manage extremely large datasets that are beyond the capacity of traditional data processing tools to manage efficiently.

*   Data is generated and collected at unprecedented speed.

*   Data stored in Big data is from different variants.

*   The value can be extracted from big data.

7.6.   Concept of Data Mining

Data mining is the process of extracting information to identify patterns, trends and useful data that would allow the business to take data-driven decision from huge sets of data is called data mining.

Data mining refers to the exploration of patterns, trends, correlations, or other valuable insights within extensive datasets. It entails employing diverse statistical, mathematical, and computational methods to scrutinize data and derive useful

knowledge. The primary goal of data mining is to reveal concealed patterns or associations in the data that can facilitate informed decision-making, forecast future events, or address particular challenges. This practice finds widespread application across various domains including business intelligence, marketing, healthcare, finance, and scientific research, enabling the extraction of valuable insights from vast and intricate datasets.

Features of data mining

- Patter identification
- Prediction
- Scalability
- Automation in processing.
- Multidisciplinary techniques
- Flexibility
- Real time analysis

7.7. Cryptography (Encryption and Decryption)

Cryptography comprises two components, "crypto" and "graphy." The prefix "crypt" signifies "hidden" or "secret vault," while the suffix "graphy" refers to "writing." Cryptography is a method used to safeguard information and communications by encoding them with codes, ensuring that only authorized recipients can access and decipher them. This involves converting sensitive information into indecipherable formats, addressing aspects of information security such as data confidentiality, integrity, and authentication. In essence, the field of encrypting and decrypting such information is known as cryptography.

Encryption

Encryption involves transforming information into an unreadable format, obscuring its true meaning. Data that hasn't undergone encryption is referred to as plaintext, while encrypted data is termed ciphertext. Typically, an encryption method utilizes a pseudo-random encryption key generated through an algorithm.
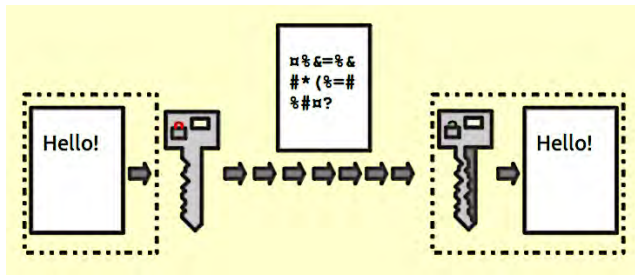
Decryption

Decryption is the process of converting encrypted information back into a readable format for comprehension. An authorized recipient can decrypt the message using the key provided by the sender to recipients.
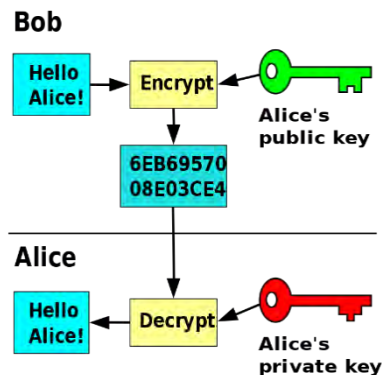
Features of Cryptography

- It helps to keep data and information confidential.
- The data integrity is maintained.
- Only authenticate users can have access to data.
- Non repudiation is possible using cryptography.
- It helps to meet security demands from small scale to large scale applications.

Uses of Cryptography

- Digital Signatures
- Secure web browsing
- Secure remote access
- Financial transaction
- Computer passwords

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- Authentication
- End to end application

7.8. Concept of VR (Vertual Reality)

Virtual Reality (VR) entails the creation of an artificial environment using hardware and software. This environment is designed to immerse the user, providing a sense of reality. VR systems employ headsets to generate lifelike visuals, sounds, and sensations, simulating the user's presence within a virtual space. Users can explore, move around, and interact with virtual elements. VR experiences are typically facilitated through head-mounted displays or specially designed rooms with large screens. This technology finds applications in entertainment, training, education, and safety.

Application of VR

a.   Entertainment

The potential of VR in entertainment is clear and huge as the entertainment industry. Consumers are always interested on its innovation and revolution. Today, the video games are explored in large and realism world through an avatar. In VR games, gamers can look in any direction or walk through the scene.

b.   Education

VR provides a means to visualize complex concepts or data involving geometric relationships that may otherwise be challenging to comprehend. In situations where accessing the real environment is expensive or poses risks to health, VR emerges as the optimal solution for comprehension and learning. For instance, training simulations in VR for activities such as flight simulation, firefighting, ensuring nuclear power plant safety, and conducting medical procedures offer valuable educational opportunities.

c.   Health

VR technology has the potential to enhance the current distributed healthcare system, particularly in scenarios where doctors need to train for routine medical procedures in remote communities globally. By immersing themselves in 3D organ models created from medical scan data, doctors can better plan and prepare for these procedures. Additionally, VR can aid in patient education by providing immersive explanations to patients and their families, enabling them to make more informed

decisions about their healthcare. Moreover, VR can be utilized as a therapeutic tool for individuals struggling with mental illness, offering potential benefits for mental health treatment.

d.   Manufacturing

Manufacturing plants are typically vast and intricate facilities housing a variety of equipment that operates continuously without pause. The flows and processes within these plants are ongoing, and even the slightest delay can have significant consequences. Much of the equipment used in manufacturing is hazardous and demands specialized training for safe operation. To address these challenges, the manufacturing industry has turned to virtual reality to model and design equipment before its implementation. This allows for thorough planning and testing, ultimately enhancing safety and efficiency in manufacturing operations.

e.   Tourism and Advertisement

Virtual Reality has been harnessed to recreate historical sites, providing users with the opportunity to experience them comfortably from their own homes. Additionally, VR has the potential to greatly enhance advertising and shopping experiences. In the realm of shopping, augmented reality is also utilized to provide detailed product information and enhance the overall shopping experience for consumers.

7.9. Concept of AR (Augmented Reality)

Augmented reality derives its name from the term "augment," signifying the act of enhancing something by incorporating additional elements. Essentially, augmented reality involves enhancing our physical environment by integrating digital elements into it. This is achieved by overlaying digital images onto the user's real-world view, thereby enriching the perception of reality.

Uses of AR

- AR in architecture projects involves overlaying a 3D model of a proposed design onto an existing space using mobile devices and 3D models.

- Mobile AR serves as a creative and highly effective educational and entertainment tool, adding an additional layer of information - such as 3D characters, images, videos, text, sound, and more - to everyday objects and environments.

- Applications that enable users to test products in real-time through AR technology are available.

- Beyond hotel environments, some companies within the travel industry are creating augmented reality apps that allow tourists to enhance physical locations and tourist attractions. This enables users to point their smartphones at buildings or landmarks and learn more about them in real-time.

- The printing and advertising industries utilize AR technology apps to superimpose digital content onto real-world magazines.

- AR technology facilitates the development of translation apps that assist in interpreting text in other languages.

Exercises

Choose the correct answer from the given alternatives.

1. The branch of computer science dealing with making computer intelligent like human is called……..

   a. Virtual reality   b. Artificial intelligence

   c. Augmented reality   d. All of the above

2. The AI devices can ……

   a. Learn from past experiences   b. Think like Human

   c. Respond to Natural Languages   d. All of the above

3. Which of the following is an application of AI?

   a. Computer Vision   b. Expert System

   c. Natural Language processing   d. All of the above

4. The process of delivering various services such as data, storage, server, database, network, etc. online is ……

   a. Cloud computing   b. Virtual machine

   c. Online computing   d. All of the above

5. Which of the following is service of computer?

   a. IaaS   b. PaaS   c. SaaS   d. All of the above

6. Which of the given is IaaS service of cloud computing?

   a. Online storage   b. Online software development platform

   c. Both a and b   d. None of above

7. The network of physical objects around us is……

   a. IoT   b. Virtual network

   c. Cloud computing   d. None of the above

8. The process of converting plain text into cipher text is ……

   a. Decryption   b. Encryption   c. Decryption   d. Converting

9. The process of converting chiper text into plain text is ……

   a. Decryption   ii. Encryption   c. Decryption   d. Donverting

10. The artificial environment created by computer hardware and software that looks like real is …….
   a. Multimedia   b. Virtual reality
   c. Augmented reality   d. All of the above

11. Which of the following is not application of Virtual Reality?
   a. Education   b. Training
   c. Entertainment   d. All of the above

12. …….involves enhancing our physical environment by integrating digital elements into it.
   a. Virtual Reality   b. Artificial Intelligence
   c. Cloud Computing   d. Augmented Reality

Write short answer to the following questions.

1. Define AI. Discuss its applications.
2. What is cloud computing? Explain different types of cloud computing.
3. What is the importance of cryptography? Discuss.
4. Compare and contrast between AR and VR.
5. Explain encryption and decryption. Write their importance
6. What is IOT? Explain its uses.
7. What is big data? Explain it.

Project works

1. Make a presentation on "Emerging Technology".
2. Consult to your computer teacher to follow the steps 'how to store information in cloud storage' and demonstrate.
3. Prepare a presentation file on a topic "Examples of Services over Cloud" and demonstrate in your class.
4. Prepare a presentation file on a topic "Sophia Robot in Nepal" and demonstrate.
5. Prepare a presentation file on a topic "Internet of Things (IoT) with example" and demonstrate.
6. Prepare a presentation file on a topic "E-Governance" and demonstrate.

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